AFCTN Test Report 94-032

AFCTB-ID 94-004

IGES Transfer and Manufacturing Demonstration

CALS EXPO '93 - AutoFact '93

MIL-D-28000A (IGES)
MIL-R-28002A (Raster)

Test Report

22 January 1994

Prepared for
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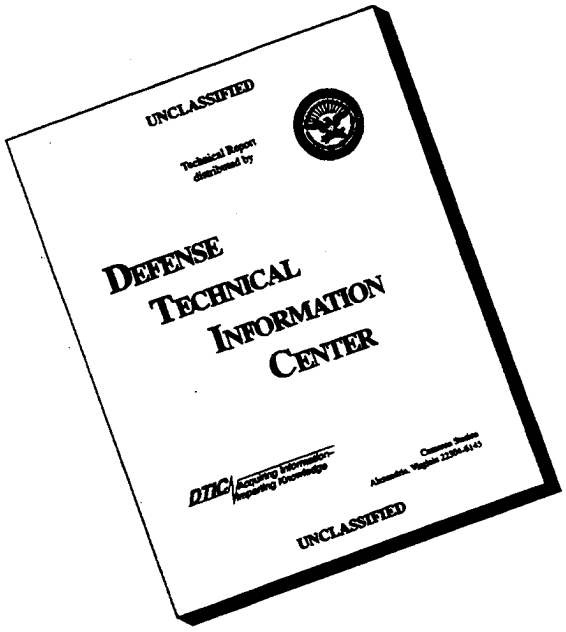

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EXECUTIVE SUMMARY

The Air Force CALS Test Bed (AFCTB) conducted the third in a series of CALS IGES transfer demonstrations for CALS EXPO '93 and AutoFact 93. This demonstration, developed to stress CALS MIL-D-28000A implementation, was the largest single IGES interoperability test ever attempted. Over 50 industries, DoD organizations, and educational institutions from around the world participated. Companies as small as 20 people to world giants, like Roll Royce, and military components of Australia, Canada, France, and the United Kingdom were represented.

Part drawing requirements were simplified to reduce manufacturing costs. Initial drawing submissions had some dimensioning errors. Scaling, absence of tolerance data, and surface finishing issues were raised by many of the participants. Several participants had to use raster files when they were unable to use IGES files. These participants reported that usable IGES files would have saved them 25 to 33 percent of their efforts.

The demonstration also produced some unexpected results. The CALS IGES files could not be imported into many of the participants CAD systems without major efforts. Single IGES files containing models with attached drawings could not be read by some CAD systems. Some IGES translators were unable to convert the files containing combined geometry and drawing data.

Seventy parts were manufactured and submitted by the participants. The parts were assembled at CALS EXPO and AutoFact without regard to the manufacturing source. Of the 70 parts delivered, only 3 could not be used in an assembly. An important observation was concluded from this demonstration: separate drawings, 3-D wireframe, surface models, and solid models should be obtained by the government when acquiring engineering data. This will permit use of various types of CAD systems for reprocurement manufacturing.

Interest was high to have a similar demonstration for CALS EXPO '94. Lessons learned from this demonstration, together with suggestions for new areas to be examined, provide a firm basis for future demonstration activities.

The AFCTB recognizes that this test could not have been successful without the help of those participating. Special thanks to Intergraph, Inc., and Image Memory Systems for their assistance in converting the part drawings to raster and IGES data files, and to Moore Quality Tooling and the Aeronautical Systems Center Developmental Manufacturing and Modification Facility for their support throughout the demonstration activities. The San Antonio Air Logistics Center is also recognized for making the selected parts drawings available to the AFCTB.

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Figures and Tables

1. INTRODUCTION

The Department of Defense (DoD) Air Force Continuous Acquisition and Life-Cycle Support (CALS) Program is an initiative to develop the ability to transfer technical information in a neutral digitized format through an open systems architecture such that the data exchanged has utility to anyone with access. To accomplish this goal the data format and "rules of language" for the data must be common to all parties. This calls for the use of specifications and standards currently approved and in use by the DoD, its contractors, and the general public. The CALS Program has adopted a set of standards and specifications to be used in the pursuit of this goal. Through proper application of these specifications and standards, data can be formatted, tagged, and organized so that transfer in an open systems environment is possible. The challenge is to have correct, complete, and unambiguous specifications and standards, and to apply them properly.

The mission of the Air Force CALS Test Bed (AFCTB), as part of the larger Air Force CALS Test Network (AFCTN), is to evaluate the effectiveness of the CALS standards for technical data interchange and to demonstrate the technical capabilities and operational suitability of those standards. The AFCTB is chartered to carry out tests to accomplish its mission.

The AFCTB conducts short informal tests of data prepared in accordance with the military standard for the Automated Interchange of Technical Information, MIL-STD-1840A, and its companion suite of military specifications. These tests allow the AFCTB staff to gain feedback from many industry and government interpretations of the standards and respond to the many requests for help that come from participants. They also increase the base of participation in the CALS initiative. Participants take part voluntarily, and benefit by receiving evaluations of their interpretation and implementation of the standards. The results of the tests are reported in Quick Short Test Reports (QSTRs) that briefly summarize the standard(s) tested, the hardware and software used, the nature of the testing, and the results. Test results confirm correct data preparation, or provide feedback to data submitters on required corrections to their processes. As a result of test result feedback, they are able to correct their procedures and create CALS compliant data. Also through these testing activities, the effectiveness and the operational suitability of the CALS specifications and standards are determined.

Another approach to determine the quality and effectiveness of CALS standards and specifications is through special test demonstrations. A particularly effective approach is the evaluation of current standards in actual production environments. Standard CALS data is provided to industry and other participants with the goal of determining the useability and functional capability of the CALS standards and specifications in a variety of real world environments.

2. PURPOSE

The IGES Transfer and Manufacturing Demonstration, was specifically designed to test the technical completeness and the operational suitability of the IGES Specification, MIL-D-28000, as it is supported and implemented by government and industry organizations. The purpose of the IGES Transfer and Manufacturing Demonstration was to prove that CALS IGES data can be efficiently transferred to, and effectively used by, disparate CAD/CAM facilities to manufacture parts for weapon systems.

An F-5 aircraft nosewheel steering subassembly shown in figure 1, page 3, was selected for the demonstration. The F-5 aircraft, an "old" weapon system still being used around the world, provided data typical of that which is available for reprocurements. The parts were selected for their close tolerance requirements in order to stress the IGES Standard, to show its capabilities, and to detect any shortfalls of the standard. The test was not to demonstrate machining capabilities as simplification of non-interfacing surfaces was permitted. An assumption was made that valid CALS IGES files could be used by most CAD systems.

3. THE PROCESS

The F-5 subassembly part data was obtained from the San Antonio Air Logistics Center EDCARS system. The data was delivered to the AFCTB on "D" size drawings. One of the goals of the demonstration was to provide a complete simulated reprocurement bid package; however, that could not be accomplished because of the delays in identifying the demonstration assembly and acquiring the required data. Image Memory Systems, Dayton, OH, provided services to convert the paper drawings into digital data. The drawings were scanned and converted to aperture cards. The aperture card data was then scanned and converted into CALS raster files.

The Dayton Intergraph office volunteered to convert the raster files into CALS Class IV files. Because the original parts were castings, discussions with the Aeronautical Systems Center (ASC) Developmental Manufacturing and Modification Facility (DMMF), Moore Quality Tooling, and Intergraph indicated that some level of simplification was necessary. Intergraph was given the option to simplify the drawing where it made sense for drawing and manufacturing since the demonstration was not a machining exercise. Intergraph used the raster files as an overlay. The raster images were scaled so that the images displayed on the screen were the exact size of the desired part. Using this basic outline, the engineering drawings were completed. To generate the 3-D model, the part had to be completely redrawn. Holes in parts 20 and 21 were not included in the IGES files because, on the actual parts, these holes are drilled in the assembly process. For this demonstration, Intergraph was asked to locate the holes and place them on the drawings. The holes were necessary for the demonstration as the parts were to be assembled at the CALS EXPO and AUTOFACT shows.

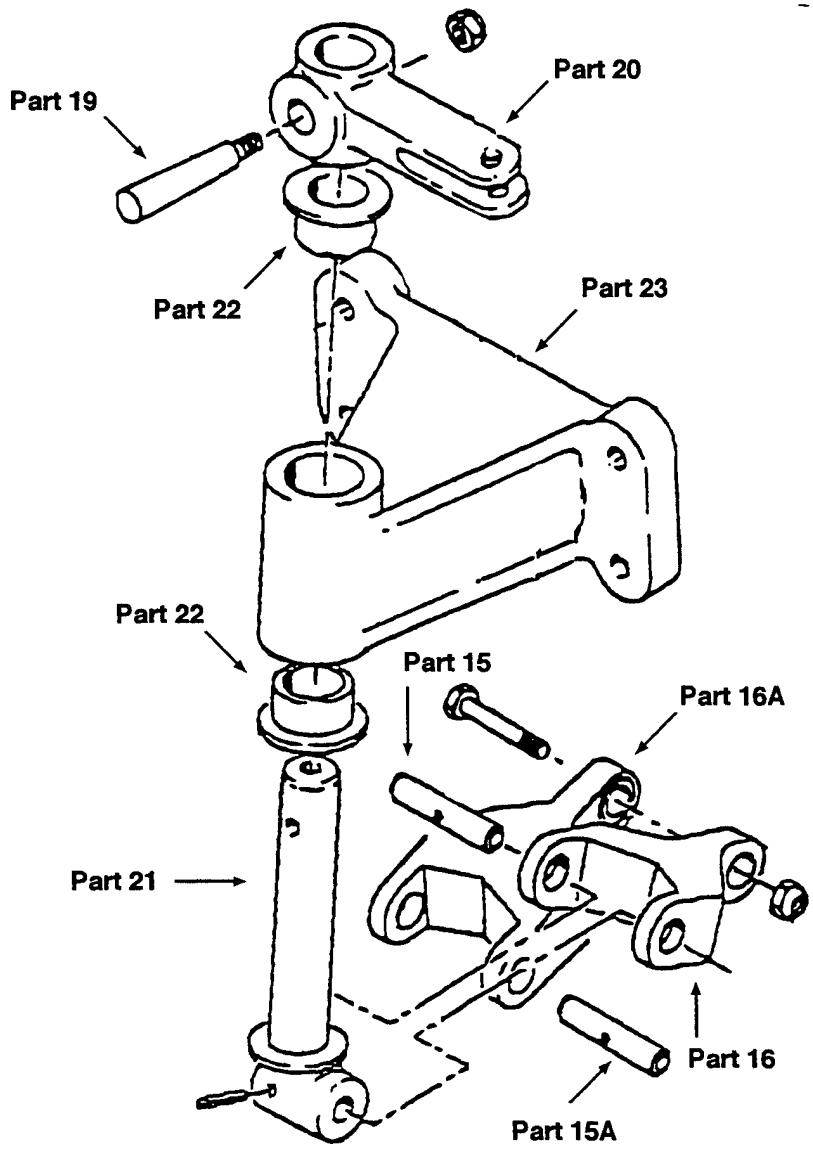


Figure 1. F-5 Aircraft Nosewheel Steering Subassembly

Each participant was asked to manufacture one part, although they were free to manufacture any of the other parts. These instructions were faxed to all participants along with their part assignment. The material from which the parts were to be made was also defined in this communication as this information was not in the drawing files. Both the IGES and the raster files were placed on the Internet node and the BBS. Note, all IGES files placed on the BBS were compressed using PKZIP to save transfer time. Participants could access the data files form either source. Some participants requested the data on floppy disks because of communications problems. Because of network problems at the AFCTB, the Internet node was not available at night. The IGES files were transmitted to the Australian participant by an electronic mail message A floppy disk was sent as a backup.

Soon after making the data available for download, many participants informed the AFCTB that they could not read the IGES files. A brief investigation determined that some CAD systems could not use the IGES part files with both the geometry and attached drawing. Intergraph was asked to provide separate drawing files with tolerance and dimension data. Because of time constraints, this second set of files was provided in accordance with ANSI IGES requirements and not the CALS Class II and IV specifications. The new set of IGES files was placed on the system for downloading by the participants could not read the first set of files.

Notwithstanding the data separation into two files, many CAD systems still could not read the files. A check of the files determined that the drawings had been created with a heavy line thickness. See Appendix B, paragraph 13.4.1.3, for sample of thick line drawing. Some CAD systems tried to use this line thickness, resulting in an unusable image. The AFCTB IDA IGESView tool was used to read in the drawing files and output the files with a normal line thickness. No attempt was made to reduced the line thickness of the 3-D model. (See the discussion in the Intergraph section, paragraph 8.2, for additional comments.)

Some systems reported errors in the models. When the models were viewed, they appeared two to three times larger than the dimensions indicated. This disparity was traced to the raster scaling that Intergraph used. Some CAD systems picked up the background scaling factor and applied it to the model display. (See the discussion in paragraph 8.2.)

Moore Quality Tooling (MQT) agreed to redraw part 20 using their AutoSurf CAD system. Both a drawing and CAD model were provided. Because of the experience level of the draftsman, all dimensions were inserted that would be required to manufacture the part. MQT also generated the file as it actually appeared. All rounded surfaces were included. These two files, the new drawing and the CAD model were added to the Internet node and BBS. Also Advent, Inc, a small business, re-accomplished part 16a from the raster file. They used AutoCAD R12 for this procedure.

Many participants still reported trouble reading the files. In an attempt to get usable files to these participants, DXF files and AutoCAD R12 files were created. While neither of these file types meet the CALS standards, the AFCTB attempted to resolve problems as they surfaced, meet the demands of the real world. It was reported by some participants that some of the drawing files contained dimension errors. All dimensions were checked and those in error were corrected. (For additional details of the problems, see the individual participant's comments in Section 10.2.)

Four participants dropped out of the demonstration because of their inability to read the files. Several other companies dropped back to the raster files and reaccomplished the drawings using their own CAD systems.

4. BCL TEST

The Army Rock Island Arsenal (RIA) agreed to generate BCL files for part 23 as an extension of their activity in the IGES Transfer and Manufacturing Demonstration. In proceeding with their activities, RIA determined that their IGES translator could not handle the surface model contained in the AFCTB IGES files. (See paragraph 10.2.39.) RIA contacted Dayton Intergraph and had 3-D wireframe files for part 23 sent to them and used this data to developed the BCL files. RIA provided the BCL files to the AFCTB for distribution to other participants. Four participants reported using the BCL files to manufacture parts at their facilities.

5. THE MANUFACTURED PARTS

The parts, along with information on the CAD systems and manufacturing processes used by each participant, were to have been delivered to the AFCTB at least a week prior to CALS EXPO. Each part was to be inspected and engraved with the participant's name so that they could be identified in the demonstration assemblies. Only a few parts arrived in time for this to be done. They were taken to MQT for inspection, and were found to be within tolerance. Because a large number of parts arrived only days before the first show, detailed inspections could not be made on most of the parts. Several parts were delivered directly to CALS EXPO.

A few problems with some of the parts that were delivered to the AFCTB, if left uncorrected, would have prevented their use in an assembly. Some parts 20 and 21 did not have the required drilled holes. The manufacturers had used the initial files provided by the AFCTB, before the correction was made to the part data (see paragraph 4). The AFCTB had the holes drilled. Also one part 23 was submitted with a hole that was too small. The Intergraph drawing file defined the hole in part 23 as counter sink instead of counter bore. The AFCTB had the hole redrilled.

Three bushings, part 22, generated as part of an educational institution's learning exercise, were too tight to fit in part 23. These were the only parts which could not be used in the demonstration

assemblies. Because of the drawing simplifications and absence of finish data, the similar parts varied, but were usable, i.e., they fit in the assembled subassemblies. One part, made by Rolls Royce, appeared to be an exact duplicate of the original part. They had downloaded the raster files along with the IGES files and had formed the rounded surfaces and inserted the webs and voids as specified in the original drawings.

6. CALS EXPO

The IGES Transfer and Manufacturing Demonstration booth shared space with the ASC DMMF booth. A map of the world showing the location of each of the participating organizations formed the central focus of a wall display. Plaques identifying each participant were placed around this map. Each plaque had a logo depicting the participating company and listed the CAD and manufacturing hardware and software used. The plaques and the map location designations were color coded to show the type of participating organization; i.e., industry, Government, or educational institution.

The manufactured parts were located on a table under the map and plaque display. Show attendees were permitted to assemble the parts. One complete assembly was provided to show the completed product. The booth had a steady flow of traffic throughout the show. Participating companies, who also had EXPO booths, British Aerospace, Roll Royce, Vickers Shipbuilding and Giat, brought their visitors to the CALS Demonstration booth to discuss the demonstration and highlight their participation.

The booth provided opportunities to talk with representatives from the participating organizations. The feedback was positive. These representatives indicated that they received more benefit from their activities in comparison to the effort and cost of their participation. Participants pointed out the demonstration surfaced problems within their internal processes that had not been identified before. All companies expressed a desire to participate in a similar demonstration next year. Also several additional companies and organizations indicated a desire to participate in future demonstrations.

7. AUTOFACT 93

The booth setup at AutoFact was slightly different than at CALS EXPO. The table with the parts was located at the front of the display area with the map and plaques located at the rear.

Interest in the manufacturing demonstration was high throughout the show. At times, people were lined up three deep in front of the table. A number of companies not involved in this demonstration expressed interest in future participation. Company representatives from foreign countries, not represented this year, expressed their interest in participating.

8. IGES FILE EVALUATION

Intergraph generated IGES files for all parts and the complete assembly. MQT created the drawing and model file for part 20. Advent, Inc created the IGES file for part 16A. The AFCTB evaluated all of these files using the IGES Data Analysis (IDA) parser and verifier. The Intergraph files were checked using the Class IV switch while the MQT and Advent files were checked using the Class II switch. The Integraph and Advent files were also checked using the basic IGES switch in the parser. These tests are discussed below. Detailed results are contained in Appendix B of this report. Note: Error 4048 reported in the CALS parser logs in Appendix B was ignored because of the change in MIL-D-28000A, Amendment 1, dated 14 December 1992,

8.1 Advent, Inc

Advent Inc., created a new IGES file for part 16A after experiencing problems with the initially provided file. The file was created using both the hard copy of the provided IGES file, and faxed copies of the original raster drawings. The resulting files were completed by the CAD designers at the company. They included dimensions necessary for the manufacture based on their experience on the shop floor. Advent used their AutoCAD R12 system with the 5.1 IGES translator. They were not aware of the slight differences in the IGES format required by CALS and did not provide a file meeting the CALS Class II definition.

The IGES file was parsed using a basic IGES parser. One caution and two notes were reported. The parser log is located in Appendix B, paragraph 13.2.1.1.

Although the file was not CALS compliant, it was parsed with a CALS Class II parser which reported one error, one caution and two notes. The parser log is located in Appendix B, paragraph 13.2.1.2. The error was a missing drawing. CALS Class II requires at least one drawing be defined:

```
ERROR   4030: CALS Class II requires that at least one drawing be defined.
```

This file was placed on BBS and Internet node late in the demonstration. It is not known if any of the participants used this file.

8.2 Intergraph

The raster files from Image Memory Systems were provided to the Dayton Intergraph office. Intergraph took the raster files into their system and scaled each drawing so that it was the exact size of the actual part. Using this underlay, the IGES files were created. (Background scaling factors, that accompanied the data produced in this operation, caused IGES data translation

problems in some CAD systems.) The files included basic dimensions and partial tolerance information. Engineering drawings meeting all of the requirements defined in DoD-STD-100 and MIL-T-31000 were not required. The demonstration was an IGES transfer test, and not a manufacturing or machining demonstration. Thus webs, voids, and rounded areas were removed or simplified.

Intergraph provide the AFCTB with one IGES file per part. The file included a surfaced model with an attached drawing. The drawing contained some dimensions and basic tolerance information. Subsequently, because of the inability of some CAD systems to use this file format, two separate files were created, a drawing file and a model file. The initial IGES files were developed to meet the CALS Class IV standard; however, the reaccomplished files were output as basic IGES files, which do not meet the CALS standards. (This error was not determined in time to develop and distribute the separate drawings and model files in CALS Class IV format.).

8.2.1 Parsed using Basic IGES

Because the reaccomplished files were output as basic IGES files, they were parsed using the default setting of the IDA Parser/Verifier. The parser log is located in Appendix B, paragraph 13.2.2.1. All files were reported with cautions and easily corrected errors. File 7350016 had five errors and file 7350010 had five warnings.

The five errors in file 7350016 relate to entity 144, trimmed parametric surface, curves that were closed. Intergraph investigated this problem.

```
 *** Entity type: 144

ERROR   2400: Curve at D     479 referenced by 142 (D     481) referenced by 144
              (D     527) is not closed.
```

The five warnings in file 7350010 relate to incorrectly set flags in entity 410, view entity. The warning comment and address directory data is shown below:

```
 *** Entity type: 410
WARNING 2389: Blank status of view at D       1 is set. This flag should be
              ignored.
CAUTION 2397: View at D       1 is not referenced by a drawing, orphan view.
  Scale of view at D       1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information at D       1.
Orthographic View entity at D       1 has  6 clipping planes specified.
   XMIN =     -2.148      XMAX =      2.066
   YMIN =     -1.324      YMAX =      1.885
   ZMIN =     -2.013      ZMAX =      1.453
    410       1       0       0       0       0       3       000000100D      1
    410       0       0       1       0                       VIEW       1D      2
```

8.2.2 Parsed using CALS Standards

An attempt was made to parse the basic IGES files using the CALS Class II and IV standards since the data for the demonstration was intended to be CALS IGES. Errors were observed as expected. The parse logs are located in Appendix B.

An additional file anomaly was identified which caused problems in many CAD systems. The output file had a value of 32 for the global line weights. The maximum number of line gradations is 32. Using IGES specification, paragraph 2.2.4.3.12 (IGES V4.0), the line weight is calculated using the line weight number from the entity times the global parameter 17 (32) divided by global parameter 16 (32) or (32/32). This will result in a line multiplier of 1 inch times the value line weight in the entity directory. The values for this is 3, which results in a line thickness of 3 inches. When displayed on the screen, normally a large block of color showed. See Appendix B, paragraph 13.4.1.3. Shown below is the information from the global section of the file:

```
Line weights           =  32
Maximum line thickness =  3.200000E+01
Minimum line thickness =  1.000000E+00
```

Below is the complete global section from file 7350020.IGS. The line weight values are pointed out. The line gradations are the number of equal subdivisions of line thickness. Line weight is the actual width of the largest line possible in the scaled file using unit as inches defined in IGES Specification, version 5.1, paragraphs 2.2.4.2.16 and 2.2.4.2.17. This has been identified as an error in the Intergraph translator and has been corrected in latest release.

```
This file was produced by Intergraph Corporation's I/IGES translator    S      1
1H,,1H;,3HEMS,11H7350020.igs,20HIntergraph Corp. EMS,31HI/CIGES   02.02.G      1
01.01 24-Jun93,32,38,7,308,15,11HUnspecified,1.,1,4HINCH,32,32.,13H9309 G      2
                                                        |  |
             Maximum Number of line weight gradations---|  |
                Width of maximum line weight in units-----|

10.102428,0.000001,12.927976608276367,11HUnspecified,11HUnspecified,9,  G      3
0;                                                                       G      4
```

Shown below is a directory entry for a line. The value for the line weight is shown as 3. This results in a value of 3 inches for the thickness of the line. Depending how the receiving CAD system handles the line thickness, either relative or absolute, the drawing may be unusable.

```
110     909       0       1       2       0       0       001010000D     587
110       3       7       1       0                  LINE        6D     588
```

8.3 Moore Quality Tooling

MQT took the raster drawing for part 20 and redrew the part using AUTODESK's Auto Surf CAD software. The CAD designers at MQT are experienced machinists and added dimensions that were necessary for the manufacture of the part.

A visual inspection of the file showed that the required MIL-D-28000A conformance statement (paragraph 3.2.2.4.1) in the Start section was not inserted.

The output files were checked using the IDA parser/verifier set for CALS Class II. The CAD software used, AUTODESK (MES) AutoSurf, does not have a specific CALS Class II output. This resulted in some reported errors. The parse log from both the CALS and basic IGES operations are included in the Appendix B.

The first reported error was missing line weights. The IGES translator output these as a value "0." The basic IGES default for this entry is "1."

```
    Line weights            =  0
ERROR   4067: CALS Class II does not allow line weights to be defaulted.
NITPICK 2326: Number of line weights must be between 1 and 32768.
    Maximum line thickness =  0.000000E+00
ERROR   4069: CALS Class II does not allow maximum thickness to be defaulted.
CAUTION 2318: Maximum line thickness specified is zero.
    Minimum line thickness =  0.000000E+00
CAUTION 2317: Maximum line thickness equal to minimum thickness.
    Granularity             =  0.000000E+00
ERROR   4066: CALS Class II does not allow granularity to be defaulted.
```

The next reported error was a missing drawing definition. MIL-D-28000A, paragraph 3.2.2.3 requires one drawing entity per sheet.

```
ERROR   4030: CALS Class II requires that at least one drawing be defined.
```

Three errors were reported in the Transformation Matrix entity, 124. One of these was an undefined font. CALS Class II files can only address fonts type 1, 1001, 1002, or 1003 (Table II). The next error was an undefined subordinate status. This value points to an non-entity in the parameter data.

```
WARNING 2492: Undefined line font value (0) specified for D       7.
ERROR   2506: Undefined subordinate status (10) specified for D       7.
WARNING 2313: Improper definition space (defining vector magnitude not unit
              by 4.354800E-06) at D     19.
```

This file was used by British Aerospace, Loral Defense Systems, and Lockheed Sanders. No problems were reported by British Aerospace or Loral; however, Lockheed Sanders reported problems in their translation of the data into SmartCAM and CATIA. See the Lockheed Sanders comments, paragraph 10.2.7, for details.

9. RASTER FILES

The "D" size drawings were sent to Image Memory Systems who scanned them. The resulting image was made into aperture cards. These cards were then converted into CALS raster files. The files were checked using various software tools available within the AFCTB and found to meet MIL-R-28002A standards. The files were used to create the baseline IGES files. Several of the participants downloaded the files and used them to validate the IGES files. Others indicated that a raster file was used to manufacture their part when they could not use the IGES data.

10. THE PARTICIPANTS

A total of 54 organizations volunteered to participate in the IGES transfer and manufacturing demonstration. They included 6 Allied country government and industry organizations, 8 educational institutions, 17 US DoD organizations and 23 industry organizations. They are listed, with their locations, in table 1 below. A few of the organizations worked together, such as the Cleveland Advanced Manufacturing Program, the Great Lakes Machine Technology Center, and the Machine Learning Center. Some organizations, such as the Oklahoma Aerospace Contract Assistance Center, were a focus of their area industry and had support from related constituent industries.

Industry/Organization	City	State	Country
AERONAUTICAL SYSTEMS CENTER DMMF	WPAFB	OH	
ADVENT INC	DAYTON	OH	
ARMY RESEARCH LABORATORY	ADELPHI	MD	
ANNISTON ARMY DEPOT	ANNISTON	AL	
AUSTRALIA DEPT OF DEFENSE	CANBERRA		AUSTRALIA
BALL AEROSPACE	BOULDER	CO	
BRITISH AEROSPACE PLC	COVENTRY		UK
CLEVELAND ADVANCED MANUFACTURING PROGRAM	CLEVELAND	OH	
CENTRAL STATE UNIVERSITY	WILBERFORCE	OH	
CUBIC DEFENSE SYSTEMS, INC	SAN DIEGO	CA	
EASTERN KENTUCKY UNIVERSITY	RICHMOND	KY	
E.W. MEISENBACH GROUP	MOLBOURNE	FL	
FRAUENHOFER-INSTITUT	BERLIN		GERMANY
GIAT INDUSTRIES/GITECH BRANCH	VERSAILLES		FRANCE
GREAT LAKES MANUFACTURING TECHNOLOGY CENTER	CLEVELAND	OH	
IMAGE MEMORY SYSTEMS	DAYTON	OH	
INTERGRAPH	DAYTON	OH	
KINCAID CUSTOM MACHINING	CLEVELAND	OH	
LAWRENCE LIVERMORE NAT LAB	LIVERMORE	CA	
LETTERKENNY ARMY DEPOT	CHAMBERSBURG	PA	
LOCKHEED-SANDERS	NAUSHA	NH	
LORAL DEFENSE SYSTEMS	AKRON	OH	
MACHINING LEARNING CENTER	CLEVELAND	OH	
MARINE LOGISTIC SUPPORT BASE	BARSTOW	CA	
MARINE LOGISTIC SUPPORT BASE	ALBANY	GA	
MCM CORPORATION OF ONEIDA	ONEIDA	TN	
MOORE QUALITY TOOLING	CENTERVILLE	OH	
NAVAL AIR WARFARE CENTER	CHINA LAKE	CA	
NAVAL AIR WARFARE CENTER	INDIANAPOLIS	IN	
NAVAL ENGINEERING TEST ESTABL	LASALLE	QUEBEC	CANADA
NORFOLK NAVAL SHIPYARD	PORTSMOUTH	VA	
OC-ALC/TIETD	TINKER AFB	OK	
OKLAHOMA AERO CONTRT ASST CTR	DEL CITY	OK	
PAKO	CLEVELAND	OH	
PENN STATE	STATE COLLEGE	PA	
PIONEER AREA VO-TECH SCHOOL	PONCA CITY	OK	
RIVERSIDE MACHINE COMPANY	CHATTANOOGA	TN	
ROBERT E BYRD INSTITUTE	HUNTINGTON	WV	
ROCK ISLAND ARSENAL	ROCK ISLAND	IL	
ROLLS-ROYCE PLC	DERBY		UK
SA-ALC/TIMCE	KELLY AFB	TX	
SANDIA NATIONAL LAB	ALBURQUERQUE	NM	
SMITHS INDUSTRIES	GRAND RAPIDS	MI	
SMITHFIELD INDUSTRIES	CLARKSVILLE	TN	
SOUTHEASTERN TECHNOLOGIES	MURFREEBORO	TN	
TENNESSEE TECHNOLOGICAL UNVER	COOKEVILLE	TN	
TRAUB	BERLIN		GERMANY
TRICO INDUSTRIES	LEXINGTON	TN	
U.S. EXTRUSIONS & TOOL	YOUNGSTOWN	OH	
VICKERS SHIPBUILDING	BARROW-IN-FURNESS		UK
WATERVLIET ARSENAL	WATERVLIET	NY	
WESTINGHOUSE ELECTRIC	BALTIMORE	MD	
WR-ALC/TIME	ROBINS AFB	GA	
WRIGHT TOOL & ENGINEERING	BLUFF CITY	TN	

Table 1. Demonstration Participants

10.1 Location of Participants

The map below shows the locations of the 53 industries, government organizations, and educational institutions that participated in the IGES Transfer and Manufacturing Demonstration.

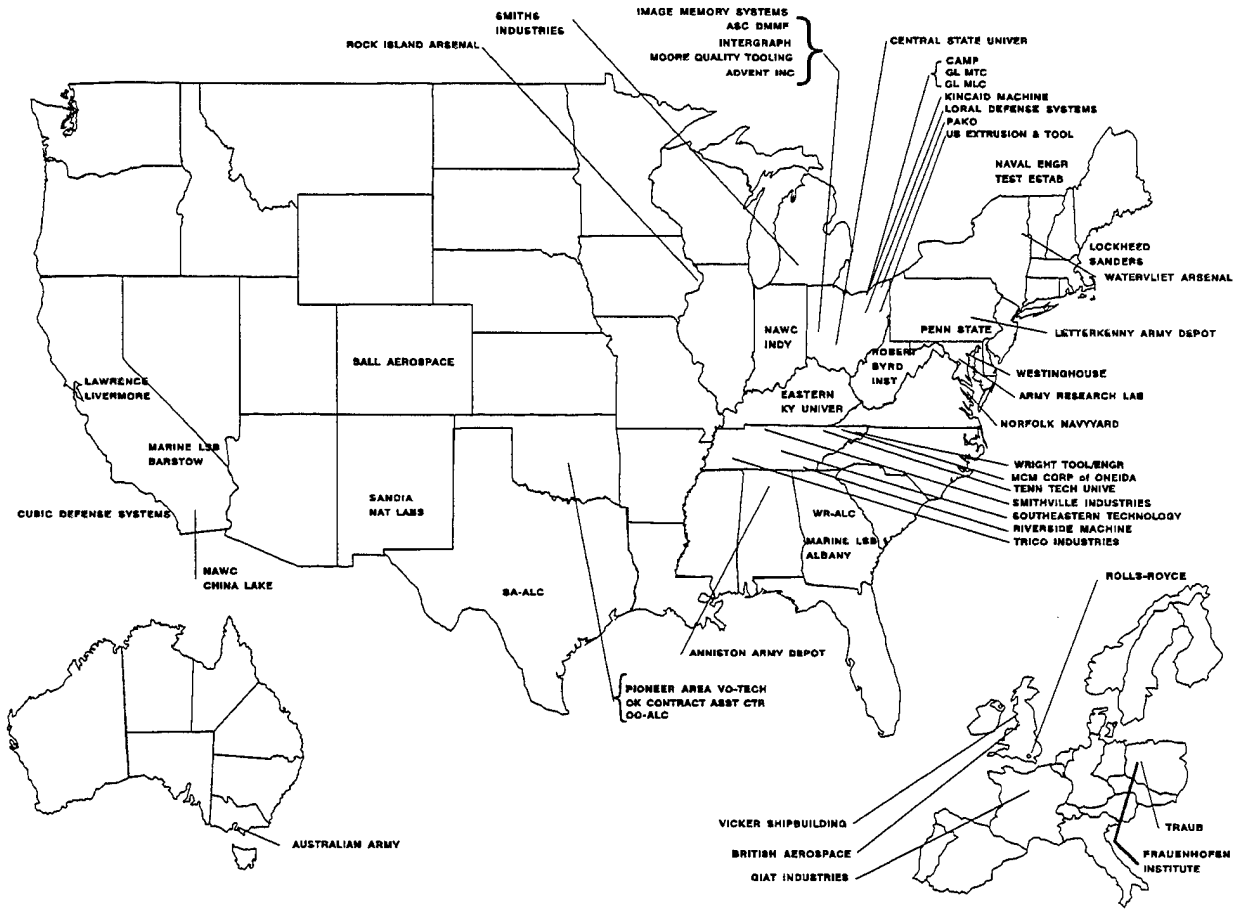


Figure 2. Location of Participants

10.2 Comments

Each of the participants was asked to provide information on the CAD systems and tools they used and problems they encountered in importing and using the SGML files in preparing to manufacture the part they were asked to produce. They were also requested to estimate the cost and time required to manufacture the assigned part. The of the information and comments received from each participant are summarized in the paragraphs that follow. All problems that were reported are also included in the summaries. In some cases direct quotes from the particiants are included.

A condensed summary of the comments relating to the IGES transfer is provided in tables 2 and 3, pages 18 and 19. The part number, the CAD tools that were used by the participants and the report of problems and their impact are indicated in the tables. Two of the 54 participants were only involved in developing the IGES files from the Air Logistics Center part drawings. The table indicates that 29, over half, of the participants did not report any problems in receiving the files and loading them into their CAD systems. Of those that did report problems, all but one were able to correct or work around the problems. This one participant was unable to use the files.

Completed parts were received from 49 of the 50 organizations that entered the process with the intent of manufacturing one or more parts. Only one manufacturer delivered a part that was not useable in the assembly process carried out at the two industry shows, and that participant also manufactured a second part which was satisfactory

10.2.1 Aeronautical Systems Center Developmental Manufacturing and Modification Facility

The ASC DMMF is a manufacturing center at Wright-Patterson AFB that does prototype work for the various Air Force laboratories and for other government organizations. The DMMF elected to produce part 21 using their 3D Systems SLA 500 Stereolithography machine. This required converting the IGES wire frame model to a solid model which took about 30 minutes. The file was then faceted using Intergraph's s I/PROTOTYPE software to produce the formatted file required for the SLA unit. This process took less than five minutes. The file was then sent via internet to the SLA processor where the file was sliced into 0.005 inch layers and built in approximately two and one-half hours. The original IGES file received by the DMMF did not include a tapered hole. Ralther than rebuild the part with updated information, the tapered howl was later insgtalled using a convential Bridgeport milling machine.

Industry/Organization	Part Number Manufactured	CAD System/ Tools Used	No Problems Reported	Reported Problems Corrected
AERONAUTICAL SYSTEMS CENTER DMMF	21	W/S Intergraph I/EMS, Intergraph I/PROTOTYPE	X	
ADVENT INC	16A	PC 486/ AutoCAD R12 w/5.1 IGES Translator		X
ARMY RESEARCH LABORATORY	21	W/S Bravo 3 CAD/CAM Integration DNC System	X	
ANNISTON ARMY DEPOT	22	W/S Intergraph I/EMS, C/EMS, I/SCAN	X	
AUSTRALIA DEPT OF DEFENSE	16A	VAXSta 3100 M76, W/S Unigraphics 9.1-5	X	
BALL AEROSPACE	15, 16A	W/S Applicon Bravo W/S Computervision	X	
BRITISH AEROSPACE PLC	20	W/S CATIA	X	
CLEVELAND ADVANCED MANUFACTURING PROBRAM	21, 22	PC 486 AutoCAD R12, EZ-CAM, W/S Intergraph I/EMS		X
CENTRAL STATE UNIVERSITY	22	PC/AutoCAD R11, PC/EZ-CAM/EZ-TURN		X
CUBIC DEFENSE SYSTEMS, INC	21	Sun Sparc CADRA 8.0.2, VAX/Unigraphics 9.1-5, 486/66/X-Windows Bravo		X
EASTERN KENTUCKY UNIVERSITY	22	Not Reported	X	X
E.W. MIESENBACH GROUP	16	Not Reported		Not Able to Use Files
FRAUENHOFER-INSTITUT	15	Not Reported	X	
GIAT INDUSTRIES/GITECH BRANCH	16A	Di-MAT System	X	
GREAT LAKES MANUFACTURING TECHNOLOGY CENTER	21,22	PC 486 AutoCAD R12, EZ-CAM, W/S Intergraph I/EMS		X
IMAGE MEMORY SYSTEMS	Note 1	486/50,. Photomatrix Aperture Card Scanner		X
INTERGRAPH	Note 2	I/SCAN, I/EMS, EMS-REVISE, I/CIGES		X
KINCAID CUSTOM MACHINING	16, 22	PC 286 AutoCAD, Anacam	X	
LAWRENCE LIVERMORE NAT LAB	21	DEC W/S Unigraphics 9.1-5, PC TekSoft ProCAM 6.0f		X
LETTERKENNY ARMY DEPOT	22	W/S Coputervision 52P CADD-4X &5	X	
LOCKHEED-SANDERS	15, 20	PC SartCAM, W/S CATIA, PC MicroCadam		X
LORAL DEFENSE SYSTEMS	20	SUN Sparc, Computervision CADDDS 5 R4, Bravo 3 N/C		X
MACHINING LEARNING CENTER	21,22	PC 486 AutoCAD R12, EZ-CAM, W/S Intergraph I/EMS		X
MARINE LOGISTIC SUPPORT BASE ALBANY	20	PC, AutoCAD R11 PC, VesaCAD 386	X	
MARINE LOGISTIC SUPPORT BASE BARSTOW	20	PC, AutoCAD R11 PC, VesaCAD 386	X	
MCM CORPORATION OF ONEIDA	22	PC 486, AutoCAD R12		X
MOORE QUALITY TOOLING	20	486/66, AutoSurf, AutoMill, AutoCAD R12 w/5.1 translator		X

Note 1. Image Memory Systems provided their services to convert the paper drawings of the assembly to CALS raster files and also to produce aperture cards.

Note 2. Integraph provided their services to convert the raster files to IGES files.

Table 2. IGES Transfer Comment Summary, Part 1.

Industry/Organization	Part Number Manufactured	CAD System/ Tools Used	No Problems Reported	Reported Problems Corrected
NAVAL AIR WARFARE CENTER CHINA LAKE	16A	Sun Sparc ProEngineer, ProE CL	X	
NAVAL AIR WARFARE CENTER INDIANAPOLIS	16	Sun Sparc (several unspecified tools)		X
NAVAL ENGINEERING TEST ESTABL	16, 16A	PC, AutoCAD, MicroStation		X
NORFOLK NAVAL SHIPYARD	23	Intergraph: W/S 6000, I/EMS, I/CALS, I/NC, I/ MAXMILL, Factory Floor Integration Sys.	X	
OC-ALC/TIETD	16	PC, Cadkey 6.0	X	
OKLAHOMA AEROSPACE CONTRACT ASSISTANCE CENTER	16	SDRC I-DEAS	X	
PAKO	All Parts	PC, AutoCAD, Surfcam	X	
PENNSYLVANIA STATE UNIV.	15	HP W/S, Unigraphics 9.1		X
PIONEER AREA VO-TECH SCHOOL	21	PC, PROCAD 3D, PROCAM 6.0		X
RIVERSIDE MACHINE COMPANY	22	PC, AutoCAD	X	
ROBERT E. BYRD INSTITUTE	15	486/50, Cadkey 6.0, SmartCam 7.0	X	
ROCK ISLAND ARSENAL	23	HP 400 W/S Unigraphics		X
ROLLS-ROYCE PLC	23	W/S, Formtek (raster), Computervision CADDS-4-X & CVNC		X
SA-ALC/TIMCE	16A	486/33, PC-APT & JPA Postprocessor		X
SANDIA NATIONAL LAB	22	W/S, Anvil 5000 R1.2		X
SMITHS INDUSTRIES	15, 22	Intergraph 2020 W/S. I/CIGES, I/EMS, I/TURN		X
SMITHFIELD INDUSTRIES	22	PC, AutoCAD, SmartCAD	X	
SOUTHEASTERN TECHNOLOGIES	16A	486/33, AutoCAD R10, Mastercam V4	X	
TENNESSEE TECHNOLOGICAL UNIVERSITY	22	PC: AutoCAD R12 (Basic IGES Translator.), EXPEDITE-3D; W/S, I-DEAS, I-DEAS GEODRAW		X
TRAUB	15	Not Reported	X	
TRICO INDUSTRIES	22	486/66, AutoCAD	X	
U.S. EXTRUSIONS & TOOL	15, 22	PC, AutoCAD R12	X	
VICKERS SHIPBUILDING	16A	VAX Applicon Bravo 4.1; HP W/S Applicon Bravo 4.1; Maxasale Mecanic NC S/W	X	
WATERVLIET ARSENAL	22, 23	PC, AutoCAD R11	X	
WESTINGHOUSE ELECTRIC	16A	HP 9000/720 W/S, Unigraphics 9.1; PC, MasterCAM		X
WR-ALC/TIME	23	Sun Sparc Computervision CADDS 5; PC, Cadkey a5.02, HiJaak Pro 2.0	X	
WRIGHT TOOL & ENGINEERING	21, 22	486, AutoCAD	X	

Table 3. IGES Transfer Comment Summary, Part 2.

CAD
W/S Based Intergraph I/EMS
W/S Based Intergraph I/PROTOTYPE

Manufacture
3-D Systems SLA 500

10.2.2 Advent, Inc.

Advent, Inc., a small business, was asked to manufacture part 16A. They commented about the IGES files and problems which they encountered. The scaling of the model file was three times larger than the actual part. (Reference paragraph 8.2, for the source of this problem.) Also database coordinates of arcs, lines, and circles did not match dimensions or end points and start points were not tangent. Database coordinates were not drawn to the middle of specified tolerances. It needed to have a connected profile where the tool path could be used. It had poor layering standards. The drawings should have been reviewed by a manufacturing entity to ensure that correct procedures and dimensioning were used.

Advent redrew part 16a. These files were made available on the Internet node and BBS. They were completed late in the procedure, so it is unknown if these corrected files were used by other participants.

The part took approximately 18-20 hours to complete at a cost of $1300. If good IGES files had been received, an estimated saving of $520 could have been achieved.

CAD
PC 486/50 platform running AutoCAD R12 with v5.1 IGES Translator.
SmartCAM Advanced 3-D v3.51

Manufacture
OKADA VM-500 using FANUC 6MB Control

10.2.3 Army Research Laboratory

The Army Research Laboratory (ARL), was tasked to manufacture part 21. They downloaded the part using Internet with no reported problems.

ARL reported programming and setup time at eight hours for a cost of $456. The actual machine time was two hours at a cost of $114. No problems were reported.

"The members of this organization appreciate your efforts in organizing and running the CALS demonstration program."--Robert White

CAD
W/S based Bravo 3, CAD/CAM Integration DNC System

Manufacture
Mori Seiki AL2 CNC Lathe
Charmille Andrew EF20-330 Wire EDM
Tree Conventional Milling Machine

10.2.4 Anniston Army Depot

Anniston Army Depot downloaded the IGES files from the Internet node. Anniston indicated that the IGES files were not usable during the manufacturing operation. They downloaded the raster files and used them to develop drawing which were used.

Anniston Army Depot produced two parts number 22 and delivered them early to the AFCTB. The parts were taken to MQT where a quality check (QC) was performed. The parts were found to be within tolerance although the uncut and radius were missing from the barrel.

CAD
W/S Based Intergraph I/EMS, C/EMS, I/SCAN

Manufacture
Monarch EE Standard Engine Lathe

10.2.5 Australia Department of Defense

The Australian Army participant was tasked to manufacture part 16A. A major problem was the inability to get the IGES files to this site. The AFCTB Internet bridge would drop during the night, which is daytime in Australia. The files were sent as an EM message. A backup floppy disk was also air mailed.

The conversion and programming time was reported as eight hours. Setup and manufacture time was two hours. They did have to convert the B-surfaces into B-curves and define the boundaries of the surfaces.

No problems were reported.

CAD
VAXStation 3100 M76 W/S based Unigraphics 9.1-5

Manufacture
ANCA 2000 CNC Mill

10.2.6 Ball Aerospace

Ball Electro-Optics and Cryogenics Division was tasked to manufacture part 15. They also manufactured a part 16a. They downloaded the files using Internet without any reported problems. No problems were reported with the IGES files.

Time to download the files, do the conversion, and send it to the shop floor was four hours, at a cost of $450. Part 15 was manufactured in 2.5 hours, at a cost of $196. Part 16 was manufactured in 12.5 hours, at a cost of $1002.

CAD
W/S based Applicon Bravo
W/S based Computervision

Manufacture
Hardinge lathe
Bridgeport mill
Bridgeport Knee 2-axis mill

10.2.7 British Aerospace PLC

British Aerospace Defense PLC was tasked to manufacture part 20. They downloaded the file using Internet with no reported problems. They used the IGES files created by MQT for their part.

No problems were expressed relating to the IGES file. The IGES file was read into CATIA where a surface/volume model was created. This file was then sent to a 3-D systems SLA 250 stereolithography unit. The output was sent to Marconi who made Investment castings. The castings were then machined. The machining was reported to take five hours. If a correct fixture had been used, this could have been done in 30 minutes.

CAD
W/S based CATIA

Manufacture
3-D Systems SLA 250
Standard Machine Tools

10.2.8 Cleveland Advanced Manufacturing Program

The Cleveland Advanced Manufacturing Program (CAMP) worked in conjunction with Great Lakes Manufacturing Technology Center and the Machining Learning Center to complete parts 21 and 22. The files were downloaded using Internet. All files were reviewed and provided to other sites. This effort was used as a learning exercise for these organizations.

Problems were reported. Some IGES translations were not complete. Several diameters were displayed in reverse. Standard drawing conventions were not used for angles and arcs. The model files were not to scale, which made it difficult to pickup missing dimensions. All of the required dimensions were not present on the drawings. Some centerlines were not shown and assumptions had to be made. Some parts had missing radii.

The parts were delivered to the AFCPO booth at CALS EXPO. Three parts number 22 were made; these were found to be slightly large when tested on the floor at CALS EXPO. Part 21 was satisfactory. No times or cost were reported.

CAD
PC 486 based AutoCAD R12
EZ-CAM
Workstation based Intergraph I/EMS

Manufacture
Charmilles EDM
Robofil 310
Mori Seiki
Bridgeport
Masco

10.2.9 Central State University

Central State University (CSU) was tasked to manufacture part 22. The manufacturing of the part was conducted as part of a teaching process at this school. The IGES files were downloaded from the Internet node without a reported problem.

CSU reported problems with the IGES files. They reported that the files appeared to have several layers of geometry over lapping one another. When they used AutoCAD R11, the results were unusable. They had to redraw the model into their system in order to make the parts. They developed an IGES file from AutoCAD which was then imported into the EZ-CAM/EZ-TURN software.

CSU reported manufacture time at five hours at a cost of $97.50. It took 1.5 hours for the IGES work and 3.5 for setup and manufacturing. "If everything had worked on the first attempt, I believe we could have reduced our total time by 25%; or 1 hour and 15 minutes. This would have decreased the estimated cost to produce this part to $73.13."--Mahmoud A. Abdallah, Ph.D., P.E.

CAD
PC Based AutoCAD R11
PC Based EZ-CAM/EZ-TURN

Manufacture
Cincinnati Milacron 1208C turning center

10.2.10 Cubic Defense Systems, Inc.

Cubic Defense System was tasked to manufacture part 21. They downloaded the IGES files using Internet without a reported problem. The part arrived at the AFCTB with three noted errors. Cubic had downloaded the initial part 21 file before the second hole was inserted. Their part arrived without this hole. The small hole in the top only went through one side. Discussion with Cubic representatives indicated that this is the way the hole appeared to them on their CAD system. The part had been plated to make it look good but this had not been considered during the manufacturing process. This resulted in a head that was .003 too wide. The ASC DMMF corrected these errors. All other dimensions were found to be within tolerance.

Cubic reported problems with the IGES files. This required additional work until the problems could be resolved. Cubic reported that the cost to make the part was about $470. They also indicated that a savings of 45% could have been achieved if the IGES files had been correct.

"Yes, we have learned a lot about IGES in the past few weeks. Our users are much more aware of what it takes to read and translate an IGES file correctly. We have started a CAD/CAM/CAE Integration Team here at Cubic which will focus on Integrating the various systems we have here at Cubic. The catalyst was the IGES exercise... It really exercised our process for accepting external files."--William Cortez

CAD
Sun Sparc based CADRA 8.0.2
VAX Based Unigraphics v9.1-5
486/66 running X-Windows Bravo 4.0

Manufacture
NC 3 Axis Machine Center
ANCA 2000 Controller

10.2.11 Eastern Kentucky University

Eastern Kentucky University was tasked to manufacture a part 22. The files were sent on a floppy disk per request. The manufacturing of the part was to be used as a master thesis for a graduate student. No problems were reported with the files. Problems were encountered in trying to get the part manufactured.

CAD
Not reported

Manufacture
Not Reported

10.2.12 E.W. Meistenbach Group

E.W. Meisenbach was tasked manufacture part 16. They were going to work with a school in the area to do the actual manufacturing. They downloaded the IGES files from the AFCTB BBS system without a reported problem. However, because of critical problems with the downloaded IGES, they were forced to withdraw from the demonstration.

The Computer Integrated Manufacturing (CIM) Center of Brevard Community College, CAD Centers of Florida, and Accudyne, Inc participated in the attempt. It was noted that receiving raster drawings would have been more cost effective with a redraw into the manufacturers CAD system than to repair the IGES files supplied.

"The State of Florida estimates that a high percentage of the funding to major DoD contractors passes through to small businesses. However, small businesses do not have the people nor the financial resources to validate computer-aided engineering support systems. Therefore, knowing what works and what doesn't work would be a great benefit to all concerned. Publishing a list of systems that correctly processed the IGES files will enable small businesses to purchase software packages that have been tested for compliance with the CALS standards."

"Business cannot continue to support non value-added processes and remain profitable and competitive in the global marketplace. If the Government wishes to participate in providing enterprise-wide solutions, certification programs must be established. These certification programs must be applied to all CALS standards and be acceptable to the joint services." Edward W. Meisenbach

10.2.13 Frauenhofer-Institute

The Frauenhofer Institute, in Berlin Germany, was tasked to manufacture part 15. They shared the file with Traub, one of the major machine tool manufacturers in Germany, and a third manufacturer. They downloaded the file using Internet with no reported problems.

Discussion with Institute personnel at CALS EXPO pointed out problems which were uncovered. No problems were reported with the IGES files. When the files were received, a meeting was held with the three organizations that were to work together to manufacture the part. Initially they thought it would take much longer; however they were able to develop a procedure that permitted them to complete the task in less than two weeks.

No actual time or costs were provided.

CAD
Not Reported

Manufacture
Not Reported

10.2.14 Giat Industries/GITECH Branch

A floppy disk containing all of the IGES files was sent to Giat Industries, in France, by Air Mail. They did not have access to Internet. They manufactured part 16a from the files and hand carried it to CALS EXPO'93. No problems were reported or time provided.

CAD
DiMAT System

Manufacture
Not Reported

10.2.15 Great Lakes Manufacturing Technology Center

The Great Lakes Manufacturing Technology Center participated with Cleveland Advanced Manufacturing Program, along with the Machine Learning Center. See paragraph 10.2.8 above for comments.

10.2.16 Image Memory Systems

Image Memory Systems is a small business. They converted the paper drawing received from SA-ALC into aperture cards. The aperture cards were used as input media for the scan conversion process to create CALS raster files.

Hardware
486/50 PC
Photomatrix Aperture Card Scanner

Software
Image Memory Systems Cardscan V1.0 R6.2

10.2.17 Intergraph

Intergraph in Dayton, OH, took the CALS raster files and generated the IGES files which were used for this demonstration.

CAD
I/SCAN
I/EMS
EMS-REVISE
I/CIGES

10.2.18 Kincaid Custom Machining

Kincaid Custom Machining, Inc., a small company, was recruited by CAMP for this demonstration. They manufactured parts 16 and 22. The files were provide via floppy disk from CAMP. No details or problems were provided.

CAD
PC 286 based AutoCAD
Anacam

Manufacture
Hurco Mill
Sheldon Slosyn

10.2.19 Lawrence Livermore National Laboratory

The Department of Energy facility, at Lawrence Livermore National Laboratory (LLNL), manufactured part 21. They downloaded the IGES files for the demonstration using Internet. LLNL was unable to use the IGES files. The part 21 model file was received as a completely B-surfaced model. The model file could have been used during computer-aided inspection but the loose tolerance permitted manual inspection instead. It was also noted that the model was twice as big as the dimension defined. (Reference paragraph 8.2, for the source of this problem.)

The part 21 drawing file also contained B-curves instead of basic lines and arcs. The low end CAD system would only import these simple entities. Comments were also received about missing tolerance and finish information. This was not part of the demonstration.

The part took 16.5 hours to manufacture at a cost of $1,567.50.

CAD
DEC Workstation based Unigraphics v9.1.5
PC based TekSoft ProCAM v6.0f (NC tool path)

Manufacture
Hardinge Lathe (conventional procedures)
Charmilles Robofill EDM

10.2.20 Letterkenny Army Depot

Letterkenny Army Depot manufactured part 22. Their part was the first to arrive at the AFCTB. This part was inspected in the QC department of MQT. The part was found to meet all tolerance with no discrepancies noted. The IGES files were downloaded via Internet. The setup time was about one hour while manufacturing took two minutes.

No problems were reported.

CAD
W/S based Computervison 52P CADD-4X & 5

Manufacture
Not reported

10.2.21 Lockheed Sanders

Lockheed Sanders was tasked to manufacture part 20. They also made part 15. Lockheed Sanders was recruited for this effort by Concurrent Technologies in Amherst NH. They downloaded the files using Internet and the BBS system without any reported problems. They offered to review IGES files for the next demonstration to ensure generic files are made available so everybody will be able to used them without any problems.

Lockheed Sanders reported major problems with the IGES files. "The major time delays were spent on data rework, not data transfer." SmartCAM with IGES translator could see only raw geometry. CATIA's IGES translator generated poor geometry. MicroCadam was able to import the DXF files successfully, but the actual part design was insufficient.

It was reported that 2 hours were used to convert the IGES files to SmartCam. An additional six hours were used to convert the IGES files to Cadam, which did not work. One and half hours were used to convert the files to CATIA. Analysis of the files for tolerances and assembly problems took four hours. Programming part 20 took eight hours. This was because the part was a casting and was being machined instead. Setup and run of part 20 took 10 hours while part 15 took three hours.

CAD
PC based SmartCAM
W/S based CATIA
PC based MicroCadam

Manufacture
Not reported

10.2.22 Loral Defense Systems - Akron

Loral Defense Systems - Akron (LDS-A) requested and were sent the data on a floppy disk. They manufactured part 20 using the IGES file created by MQT.

They reported problems in that the tolerance data and surface finish information was omitted. The surface information was not critical to this demonstration. They also reported, because they only had the IGES files for one part of the assembly, it was not possible to check for fit. They also reported problems relating to adding the hole which was overlooked.

LDS-A reported no saving other than that required to generate the geometry for the part. It took approximately one hour to convert the IGES to CV format, plotting the data, and transferring the data to the manufacturing function. The manufacturing function reviewed the data for two hours, and determined that enough information was available to set up fixturing and other requirements. Because only one part was needed, the part was manufactured in ten hours on manually operated machines.

"All in all, LDS-A's participation in this project served to uncover those areas of strength as well as those needing improvement, when dealing with digital transfer of data."--Michael Lewis

CAD
SUN Sparc based Computervison CADDS 5 R4
Bravo 3 N/C

Manufacture
Not Reported

10.2.23 Machining Learning Center

The Machining Learning Center participated with Cleveland Advanced Manufacturing Program, along with the Great Lakes Manufacturing Technology Center. See paragraph 10.2.8 above for comments.

10.2.24 Marine Logistic Support Base - Albany

The Marine Support Base, at Albany, was tasked to manufacture part 20. They downloaded the files using Internet after receiving instruction of procedures. They also provided the files to the Barstow site.

No problems were reported. They did request permission to use the simplified Intergraph part 20 IGES files. Even though their part had a square barrel, it still fit the assembly without a problem. They delivered the part to the AFCTB booth at CALS EXPO.

CAD
PC Based AutoCAD R11
PC Based VesaCAD 386

Manufacture
Bridgeport E-Z CAM
Monarch VMC w/Fange Controller

10.2.25 Marine Logistic Support Base - Barstow

The Marine Logistic Support Base, at Barstow, was tasked to manufacture part 20. They received the files from MLSB Albany as E-mail message attachments. The drawings were received as .DWG, .IGS, and .PRT formats. The .PRT format was not usable. Some data (text, arrows, etc.) did not convert completely from the .IGS and .DWG files, but enough information to manufacture the part was recovered. They requested permission to manufacture the simplified part 20 because of the late receipt of data. Even though their part had a square barrel, it still fit the assembly.

CAD
PC Based AutoCAD R11

Manufacture
Bridgeport VCM

10.2.26 MCM Corporation of Oneida

MCM Corporation of Oneida, a small business, was recruited by the University of Tennessee to participate in the demonstration. They were tasked to manufacture part 22. MCM downloaded the files from the AFCTB BBS using a high speed modem. The high speed modem at the AFCTB was reported as dropping the carrier and the 2400 baud system had to be used.

The IGES files were all received without a problem. However, they were unable to import the files into AutoCAD. They had difficulty with IGES translation, specifically with drawing element (curve) definitions. They loaded the .DWG file set and were able to use that file.

The part took 42 minutes to program and setup. The manufacture time was 40 seconds. The cost of the part to manufacture was $70.

CAD
PC 486 base AutoCAD R12, Standard Translator

Manufacture
Mazak 10M CNC lathe

10.2.27 Moore Quality Tooling

MQT received the files via floppy disk. They had problems with the files and offered to regenerate the IGES files for part 20 using the raster files. They used both the casting and machined drawing to recreate the part. They had to modified the file, adding the second hole after it was determined where it was to be placed. This was the hole that was drilled after the parts were put together on the landing gear.

MQT also provided some QC on the first parts that arrived.

Time and cost of the process were not reported.

CAD
486/66 PC based AutoSurf
486/66 PC based AutoMill
486/66 PC based AutoCAD R12 w/5.1 translator

Manufacture
Hurco

10.2.28 Naval Air Warfare Center - China Lake

NAWC China Lake was tasked to manufacture part 16a. They downloaded the IGES files using Internet without a reported problem. They were able to use the files to create an SLA file from which a stereolithography part was created.

No problems or time were reported.

CAD
Sun Sparc ProEngineer
Sun Sparc ProE CL

Manufacture
Mazak V-7.5 4-Axis Vertical Mill

10.2.29 Naval Air Warfare Center - Indianapolis

NAWC Indianapolis was tasked to manufacture part 16a. They downloaded the IGES file for part 16a using Internet. They also downloaded the raster files for part 16. In discussion with NAWC, they said they would make part 16 using the raster files.

It was reported that the IGES file for part 16a had missing data. Several different CAD systems were tried, all of which generated incomplete images and models. They also tried to convert the complete assembly IGES file without success.

NAWC manufactured eight total parts using about 80 man hours as part of a learning experience. They felt that if good IGES files had been available from the start they could have cut time from the process.

They requested that a complete bid package be used next year. They would also like to stress some of the other functions required in digital bid packages.

CAD
Sun Sparc - Multiple
AFCTN Xrastb

Manufacture
Wire EDM
Vertical Mill

10.2.30 Naval Engineering Test Establishment

The Naval Engineering Test Establishment (NETE), of the Canadian Navy was tasked to manufacture part 16. They also manufactured part 16a. This is the second time NETE participated in the Manufacturing Demonstration. The Canadian DND supported this demonstration. A separate report is being prepared detailing problems of using CALS IGES.

NETE downloaded the IGES files using Internet. No problems were encountered during the download and they rated this part of the test excellent.

NETE had problems with the IGES files. They did not have an IGES translator on their system. They requested the native Intergraph files which were placed in the Internet node. Because they were using MicroStation, they were unable to read the native Intergraph *.PGN files. They were able to translate the DXF files. The Intergraph office in Montreal translated the IGES files into a format that could be used by MicroStation.

On some variants of the drawing the parts were barely recognizable. None of the files provided all of the information required to manufacture the part. Dimension and arrow heads were missing. One dimension was reported as being mirrored.

NETE also downloaded the AFCTB Xrastb tool along with the raster files from part 16 and 16a. They were able to print these files and use them during the manufacturing process.

They reported that engineering time of approximately 25 hours was required to generate usable drawings. They used manual machines to make both part 16 and 16a, which took approximately 15 hours each.

"In conclusion, the process was a useful learning exercise. In our opinion, it has also shown the need for standards and both the need for an the lack of existence of a uniform application of these standards."--Ivan Fuchs, Consultant, NETE

CAD
PC based MicroStation

Manufacture
Manual Machining Tools

10.2.31 Norfolk Naval Shipyard

Norfolk Naval Shipyard manufactured part 23 using the IGES files downloaded via Internet. No problems were reported by this participant. They used Intergraph hardware and software to work the files and provided it to the product floor. Approximately 24 hours of labor were used to manufacture the part.

CAD
Intergraph 6000 W/S
- Intergraph I/EMS
- Intergraph I/CALS
- Intergraph I/NC
- Intergraph I/MAXMILL
- Intergraph Factory Floor Integration System

Manufacture
Monarch Vertical Machining Center M150B

10.2.32 OC-ALC/TIETD

Oklahoma Air Logistic Center (OC-ALC) was tasked to manufacture part 16. They hand delivered the part to the AFCTB booth at CALS EXPO. No problems or other information was provided.

CAD
PC Based Cadkey v6.0

Manufacture
SmartCAM v7.0
Emco-Marie Turn120P
Bridgeport 2J

10.2.33 Oklahoma Aerospace Contract Assistance Center

The Oklahoma Aerospace Contract Assistance Center was the focal point for the demonstration in Oklahoma. They were tasked to manufacture part 16. They had to use the raster file in order to manufacture this part.

No problems or other information was provided.

CAD
SDRC I-DEAS

Manufacture
Manual Direct Input Engine Lathe Rotary Head

10.2.34 PAKO

PAKO, Inc. is a small business recruited for the demonstration by CAMP. They manufactured all of the parts. No problems or other details were indicated by the company. The IGES files were delivered to the company on floppy disk by CAMP.

CAD
PC based AutoCAD
PC based Surfcam

Manufacture
LeBlond Makino
Mori Seiki

10.2.35 Pennsylvania State University

Pennsylvania State University was tasked to manufacture part 15. They downloaded the IGES files using Internet with no reported problems.

Because only one part was to manufactured, it was not deemed cost effective to program a CNC machine to manufacture one part. The IGES drawing was given to a machinist who used manual tools to make the part, which took about one hour to make. If a CNC machine had been used, it is estimated the time saving would have been 50%.

Penn State reported problems with the IGES file. The surface of the counter-sink did not trim correctly to the outer surface.

CAD
HP W/S based Unigraphics 9.1

Manufacture
Manual lathe and mill

10.2.36 Pioneer Area Vo-Tech School

Pioneer Area Vo-Tech School was tasked to manufacture part 21. They used this demonstration as a learning tool for CNC students in the school. They downloaded the IGES files from the BBS system. They were initial contacted by the Oklahoma Aerospace Contracting Assistance Center and then worked directly with the AFCTB. They did lose some of the initial information during this process.

The school provided a very detailed breakout of time and procedures used by the students. The reported time was 6.5 hours. Because students were involved, some of the procedures were slower than in a production mode. They used conservative feed rates and slow turning speeds. Quality checks were performed often to ensure tolerances were correct. It was estimated that one hour could have been saved using normal procedures.

They reported problems with the IGES file. It was "little difficult to interpret" because it was not drawn as expected. PROCAD 2D would not convert the drawing while PROCAD 3-D displayed some errors. Some of the dimensions were mirrored reverse.

"More lead time would be appreciated next year. We did enjoy the Challenge. Thank you ... for the opportunity for our students."--Teresa Nelson

CAD
PC based PROCAD 3D & PROCAM 6.0

Manufacture
Okuma LB-15 Lathe
Okuma MC-4VAE Machining Center

10.2.37 Riverside Machine Company

Riverside Machine Company a small business, was recruited by the University of Tennessee for the demonstration. They manufactured part 22. They received the files from Martin Marietta Energy Systems, in Oak Ridge, who downloaded the files via Internet and sent via floppy disk. They reported no problems.

Riverside did not use the model file. They manually programmed the CNC equipment.

CAD
PC based - AutoCAD

Manufacture
Moriseika CNC lathe

10.2.38 Robert E. Byrd Institute

Robert E. Byrd Institute download part 15 IGES files using
Internet. They also downloaded the raster data for the part to ensure dimensions were correct. No problems were reported.

They downloaded the files and used them in Cadkey 6.0. They exported the CAD file to SmartCam to generate the NC paths.

The programming and setup time were estimated at 2.5 hours. The actual machining time was 2.5 minutes. The cost of the part is estimated at $149.16.

CAD
486/50 PC based Cadkey 6.0
486/50 PC based SmartCam 7.0

Manufacture
Bridgeport M2J Mill

10.2.39 Rock Island Army Arsenal

Rock Island Arsenal was one of the key players in the demonstration. They provided the BCL coding which was used by some of the other participants to make part 23.

Rock Island Arsenal was tasked to manufacture part 23. They downloaded the IGES file using Internet. They initially had problems (details not available) with the IGES file and contacted the Dayton Intergraph office for a 3-D wireframe model, which their system could handle.

While cost data was not provided, approximate times were given. Rock Island Arsenal estimated 60 hours were required to retrieve and analyze the IGES data and develop a manufacturing plan. An additional 54 hours were required for setup and fixture development. Twelve hours were required to do the BCL coding and ten hours to do the actual manufacturing. They indicated that the cost savings would be achieved through the use of the BCL coding for additional part manufactured at other sites.

Rock Island reported problems with the surfaced model and scaling of the model. They said that simple bolt holes were represented by B-curves, which is an over kill in the CAM area where only the center point and arc is required. The B-curve did not have a center point in their CAD system. They had to get a wireframe model in order to get this information. The model origin was not present on the model file. They also made a comment about the missing tolerance and surface finish information.

CAD
HP Model 400 W/S running Unigraphics

Manufacture
Kearney & Trecker ORION M2200 w/BCL/CNC controller

10.2.40 Rolls-Royce PLC

Rolls Royce (RR) manufactured part 23 using supplied data. They used both the raster and IGES files. The part was hand delivered to the AFCTB booth at CALS EXPO '93. The part was an exact duplicate of the original part in the F-5. Rolls Royce used data on the raster files to add the webs and voids in the part, more than they were required to do. They even heat treated the part per requirements defined in the raster drawing.

RR was able to convert the geometry in the IGES file, but additional information was added to ensure the part was an exact duplicate. Undefined problems were noted in the letter from RR.

CAD
W/S based Formtek (raster)
W/S based Computervison CADDS-4X
W/S based Computervison CVNC

Manufacture
Mazak AJV 35/60 Machining Center

10.2.41 SA-ALC/TIMCE

San Antonio Air Logistic Center (SA-ALC) was tasked to manufacture part 16a. The part was hand delivered to the AFCTB booth at CALS EXPO '93. The IGES files were downloaded from the AFCTB BBS system with some problems. Access to outside lines at SA-ALC caused problems. Attempts to use the Internet system resulted in problems as well.

SA-ALC also took it upon themselves to generate both APT and BCL coding which they made available on the AFCTB BBS. Part programming time was less than 40 hours. The setup time was reported as four hours. Actual manufacturing time was estimated at 50 minutes.

The use of CALS IGES Class IV does not permit all information required for manufacturing to be passed. This includes surface finish, materials, and tolerance information. A combination of file classes is necessary to pass all required information.

SA-ALC reported problems with the IGES files. The IGES files were created on a UNIX system and moved to DOS based platforms. UNIX and DOS handle the end of line differently and this caused some problems. A Fortran program was written to handle the differences of <LF> and <CR>. The IGES files data sequence could not be handled by the translator. The entities were defined prior to definition of the corresponding matrices.

"I appreciate the support of you and staff in going beyond all expectations in making available all the multiple file formats and options. Really, thanks."--Jerry Myer

CAD
PC based 486/33 PC-APT
PC based 486/33 JPA Postprocessor

Manufacture
Cincinnati 10VC 3-Axis Mill
Bridgeport Mill

10.2.42 Sandia National Laboratories

Sandia National Laboratories was tasked to manufacture part 22. They downloaded the parts from the Internet system.

They reported that it took two hours for programming and setup, and an additional eight hours to manufacture the part. They had problems with the IGES file and indicated that programming and setup could have been cut in half with good files, and an additional two hours saved during manufacture.

They reported problems in that the IGES model did not agree with the geometry as it appeared on the drawing. (Reference paragraph 8.2, for the source of this problem.) The lack of complete tolerance information was cited as a concern.

CAD
W/S based Anvil 5000 R1.2

Manufacture
Standard NC Machine tools

10.2.43 Smiths Industries

Smiths Industries, located in Grand Rapids, MI, was tasked to manufacture part 15. They also manufactured part 22. They downloaded the IGES files using Internet through a second site. This caused problems in that this transfer could take several hours to an additional day and that the exact file name and locations must be known.

"If everything worked, the electronic data could be used to generate machine cutter paths in addition to sketched on work instructions. Unfortunately, the IGES files we received were not accurate and after several unsuccessful attempts at retrieving that data left us with a very low level confidence level in the accuracy of the information. We found the IGES files to be difficult to work with. This may be due to our inexperience with this format, but regular EMS modeling data would have been less difficult to use."--Marty Alberts

Smiths Industries reported that part 15 took one hour to machine while part 22 took four hours of programming and setup, and 3.5 minutes to make.

CAD
Intergraph 2020 W/S running I/CIGES, I/EMS, I/TURN

Manufacture
Hardinge Precision Lathe
Hardinge Conquest C42 w/ Fanuc OTC
Bridgeport Series I Knee Mill

10.2.44 Smithfield Industries

Smithfield Industries, a small business, was recruited by the University of Tennessee to participate in this demonstration. They manufactured part 22. They received the files from Martin Marietta Energy Systems, in Oak Ridge, who downloaded the files via Internet and sent via floppy disk.

They reported that model files had been created using surface modeling and extrusion capabilities of the output system. They feel as though the files should be output in 2-D and let the CAM system do the required translations. This will permit the capabilities of the machine tools to be used to the greatest ability. This points to the used of three files for manufacturing parts.

Smithfield did not use the model file. They manually programmed the CNC equipment. The manufacture time included 45 minutes to program and setup and three minutes to manufacture. They estimate the cost at $12. If this had been a production run the cost would have been $3.19.

CAD
PC based AutoCAD R10
SmartCAM

Manufacture
Hardinge CNC lathe

10.2.45 Southeastern Technology

Southeastern Technology was recruited by the University of Tennessee to participate in the demonstration. They manufactured parts 16A. No information on problems was provided.

Setup and programming to manufacture the part took 50 minutes. The actual manufacturing time was 10.5 minutes at a cost of $35.

CAD
486/33 PC based AutoCAD R10
Mastercam V4

Manufacture
Mori Seiki MVJR Vertical Milling Machine with FANC 10C controller

10.2.46 Tennessee Technological University

Tennessee Technology University was recruited for the demonstration by the University of Tennessee. They were tasked to produce part 22. They downloaded the files using Internet.

The files could not be imported into AutoCAD R12 or I-DEAS solid modeling module. They were able to import the file into the GEODRAW model of I-DEAS and EXPEDITE-3D. The file was redrawn in GEODRAW, which was used to output the file and plot used to manufacture the part. The part was manufactured using a manual procedure in three hours.

The part submitted to the AFCTB was inspected at MQT. All major dimensions were within tolerance. The undercut on the barrel was present but the 0.030 radius was missing.

CAD
PC based AutoCAD R12, Basic IGES Translator
PC based EXPEDITE-3D
W/S based I-DEAS
W/S based I-DEAS GEODRAW

Manufacture
Manual lathe

10.2.47 Traub

Traub, one of the major tool manufacturers in Germany, manufactured part 15 in conjunction with the Frauenhofer Institute. The files were downloaded using Internet.

10.2.48 Trico Industries, Inc.

Trico Industries, Inc. is a small business located in Lexington, TN. They are one of the companies the University of Tennessee recruited to participate in the demonstration. They manufactured part 22. They received the files on a floppy disk from Martin Marietta Energy Systems, in Oak Ridge, who downloaded the files via Internet. No problems or manufacturing information were provided.

CAD
486/66 based AutoCAD

Manufacture
Manual procedures

10.2.49 US Extrusion Tool & Die

US Extrusion Tool & Die was recruited for this demonstration by CAMP. They manufactured parts 15 and 22. No further details were provided.

CAD
PC based AutoCAD R12

Manufacture Not Reported

10.2.50 Vickers Shipbuilding

Vickers Shipbuilding and Engineering, of Barrow-in-Furness UK, was tasked to manufacture part 16a. They downloaded the files using the dial-in BBS. They reported no problems with the download or IGES files.

They reported a setup and programming time of one hour. The machining operation took six hours. It was indicated that the part would normally be a casting which would cut machining time. They also indicated a minor problem in finding a machine small enough to handle the part as they normally work with very large parts.

CAD
VAX based Applicon Bravo V4.1 /Editor/Draft
HP W/S based Applicon Bravo
Mexasale Mecanic NC Software

Manufacture
AGIE 100 EDM

10.2.51 Watervliet Army Arsenal

Watervliet Army Arsenal manufactured parts 22 and 23. They downloaded the IGES files and BCL files via Internet. After they completed the parts, but before they sent them to the AFCTB they called and asked about the countersink Vs counterbore issue on part 23. I asked them to check the parts, which they found did not fit. They corrected part 23 before sending it to the AFCTB.

The time to manufacture part 22 was 3.7 hours. Part 23 took 9 hours. No additional information was provided.

CAD
PC based AutoCAD R11

Manufacture
K&T Horizontal Mill
Hardinge Lathe

10.2.52 Westinghouse Electric Corporation

Westinghouse Electric Corporation, Electronic Systems Group, in Baltimore, was tasked to manufacture part 16A. They downloaded the IGES files from the Internet system. While part 16a is steel, Westinghouse requested permission to use aluminum. Because the goal of the demonstration was not to generate actual aircraft parts, permission was given.

Westinghouse reported some problems with the IGES files. They had to use the DXF files as a backup. It took three hours to build the solid model from the provided data. It took an additional eight hours for CAM programming and post processing operations. The actual setup and manufacturing took four hours. No cost estimates were provided.

Westinghouse reported problems with the trimmed surfaces in the model file. They assumed that the model was initially created as a solid. Their Unigraphics software did not translate the trimmed surface correctly. They suggested a wireframe model be provided as a better way to represent edges.

CAD
HP 9000 Series 720 W/S based Unigraphics 9.1
IBM PC based MasterCAM

Manufacture
Bridgeport Interact II M32 CNC Vertical Mill w/ Heidnhain TNC 151 Controller

10.2.53 WR-ALC/TIME

Warner-Robins Air Logistic Center was tasked to manufacture part 23. They downloaded the BCL and IGES files from the Internet node. They used the BCL file created by Rock Island Arsenal to manufacture the part. They also used the raster files on the system and modified the file by rounding the top surface instead of leaving it square. They also caught the counter-sink vs. counter bore problem and corrected the file.

No problems or times were reported.

CAD
Sun Sparc based Computervision CADDS 5
PC based Cadkey 5.02
PC based HiJaak Pro V2.0

Manufacture
Cincinnati Milcron T-10
Entek Advantage 2000 BCL System

10.2.54 Wright Tool & Engineering, Inc.

Wright Tool and Engineering, a small business, was recruited by the University of Tennessee to participate in the demonstration. They manufactured parts 21 and 22. They had problems in downloading the files from the dial-in BBS system due to noise on the telephone line. They tried three times without getting complete files.

WTE received the files from Martin Marietta Energy Systems, in Oak Ridge, on floppy disk who downloaded the files via Internet. They reported no other problems with the transfer and manufacturing.

The time to produce part 21 was one hour of setup and 1.5 hours to manufacture. Part 22 took 40 minutes to program and 17 minutes to manufacture. They did not use the model file and manually programmed the CNC machines.

The owner of this company gave a presentation at CALS EXPO which was reportedly well received. He detailed the demonstration and some of the lessons learned.

CAD
PC 486 AutoCAD

Manufacture
KIA CNC Lathe
Mazak VQC CNC Mill
Hardinge conventional lathe

11. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

11.1 Summary

The purpose of the IGES Transfer and Manufacturing Demonstration was to prove that CALS IGES data can be efficiently transferred between and effectively used by disparate CAD/CAM facilities to manufacture parts for weapon systems. The demonstration, was specifically designed to test the technical completeness and the operational suitability of the IGES Specification, MIL-D-28000, as it is supported and implemented by government and industry organizations. Typical reprocurement data for parts of the F-5 aircraft nosewheel steering assembly was selected for the demonstration. This demonstration followed two earlier similar demonstrations in which voluntary participants supported the AFCTB in testing selected attributes of the CALS standardization initiatives. Previous participants encouraged other organizations to be involved in this demonstration. Fifty-four organizations became involved, 50 volunteering to manufacture parts from AFCTB provided data files and 4 to assist the data file development and other activities.

The AFCTB prepared a set of IGES files for the selected parts. Participants downloaded the IGES data files from two AFCTB electronic sources. Problems surfaced with file/data interface compatibility with the various participant's CAD tools. Nearly half of the participants had some difficulty accessing or using the data. A second set of files was provided to meet the more limited CAD capabilities of some of the participants. Other problems with the data were discovered and resolved during the demonstration. Manufactured parts were received from 51 of the 52 participants attempting to complete the manufacturing process.

The results of the demonstration were displayed at the 1993 CALS EXPO and AUTOFAC exhibitions. These displays generated considerable interest and interaction among the participants and with other attendees at the two shows.

11.2 Conclusions

The demonstration attracted attention to CALS and in particular to the transfer and use of IGES data. The participants felt their involvement was beneficial to them and worth more than the investment they made in participating. The real world problems with the IGES files required the industry and other organizations that participated to be creative in solving these problems. Added

value resulted in that particular problems in participants IGES CAD systems surfaced and were corrected. The involvement also created a better understanding of the need for strict CALS compliance. The AFCTB gained considerable knowledge and perspective in the progress that industry and other organizations have made in developing CALS compliant IGES capabilities. A number of lessons were learned in the conduct of this ambitious test demonstration.

While many problems, including real world problems of time, surfaced during this demonstration, it was judged a success. It is clear that correct initial data would have mitigated several problems that surfaced. However, many participants used basic IGES tools, some successfully, which have later versions. These later versions have been developed to CALS Class II and Class IV requirements. Their application would have permitted still greater successes.

This demonstration illustrated that drawings are subject to varied interpretation. The procedures that several of the participants went through to generate IGES files are not unlike those that must be accomplished for every reprocurement unless accurate and compatible digital data is available.

IGES was effectively demonstrated as a viable CALS data format for remanufacturing parts from archived data; however, closer attention to the standards is required to ensure translation problems are minimized. It was demonstrated that CALS raster files are also usable for the remanufacturing process. The demonstration indicated that with quality IGES files, companies can bid and manufacture at a lower cost.

11.3 Lessons Learned and Recommendations

Reprocurements can be executed quicker and at lower cost if good engineering documentation, i.e., good IGES files, are available. The CALS initiative should work towards the establishment of a requirement for programs to acquire and manage IGES files for all weapon system support.

The demonstration clearly pointed out that large IGES files cannot be used by smaller systems. When using a major CAD system to generate IGES files, the target system must be kept in mind. It is important that IGES engineering data requirements should be judiciously defined if the acquired data may be used in smaller CAD systems, i.e., at a later time for reprocurements. Data requirements should be defined so that individual IGES files, i.e., 2-D files, 3-D wireframe, surface models, etc., are specified. This will ensure the highest level of transfer capability is preserved.

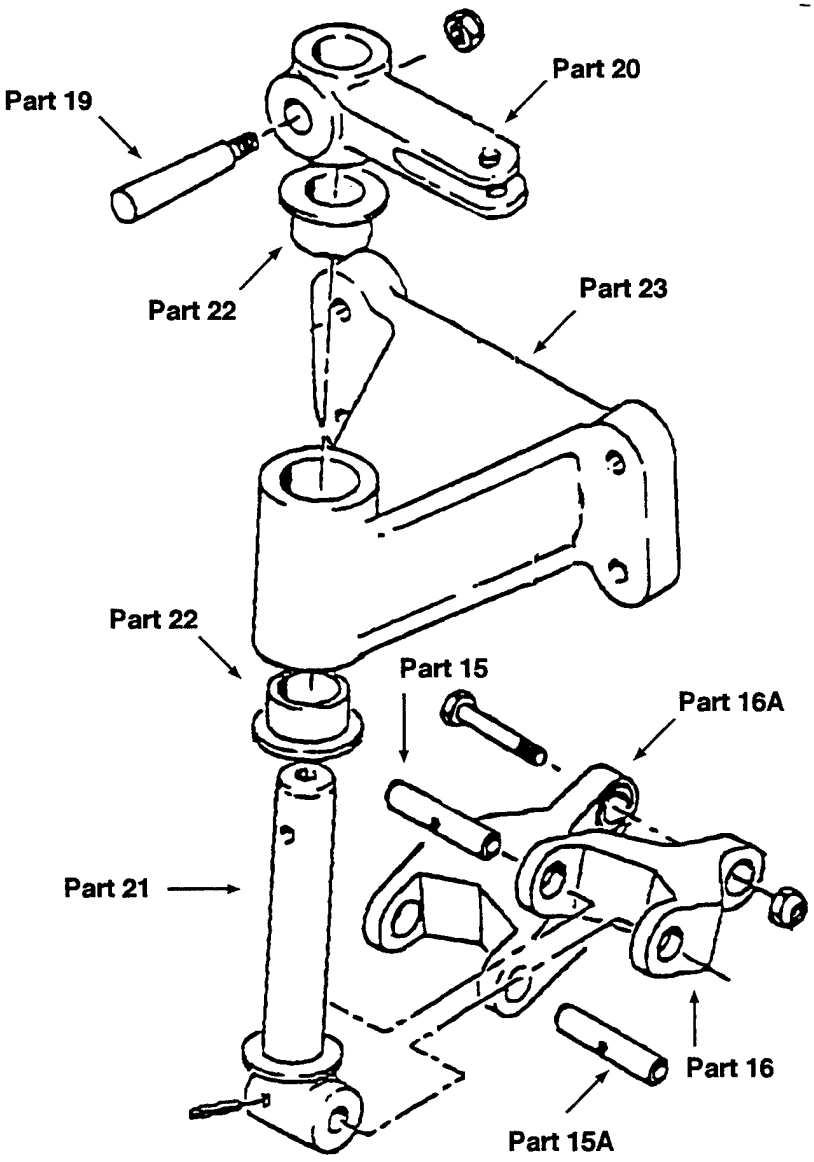
While this demonstration was designed to test the ability of IGES data to be transferred between systems and used in manufacturing, simplifications were permitted. Demonstrating machining capabilities was not one of the goals of the test. It was discovered that companies and

organizations still looked for specific detailed information on drawings. IGES data can be sufficiently detailed to provide all of the information required for manufacturing.

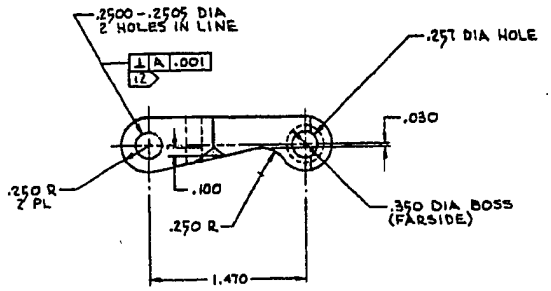
The time taken to identify an appropriate assembly, obtain the drawings, and convert them to IGES files precluded a close inspection of the files that were initially released. Large demonstrations need to be coordinated and conducted with adequate time to complete each phase. A careful review of the IGES files could have prevented some of the problems that surfaced during the demonstration. Several companies and organizations offered to review all files prior to release for the next demonstration. Interest in future demonstration participation was expressed by this years participants and others who visited the AFCTB booth at the CALS and AutoFact expositions.

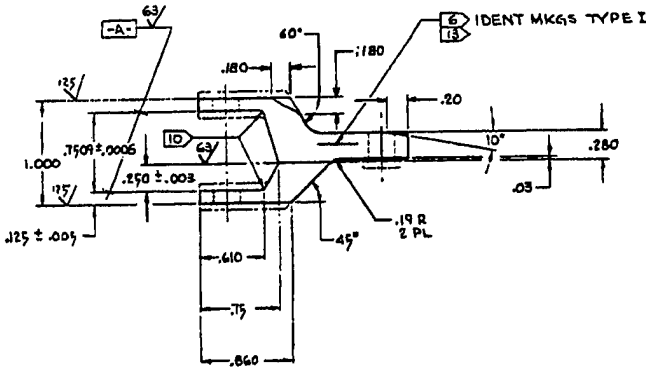
12. APPENDIX A - RASTER FILES

12.1 Complete Assembly



12.2 Part 16A

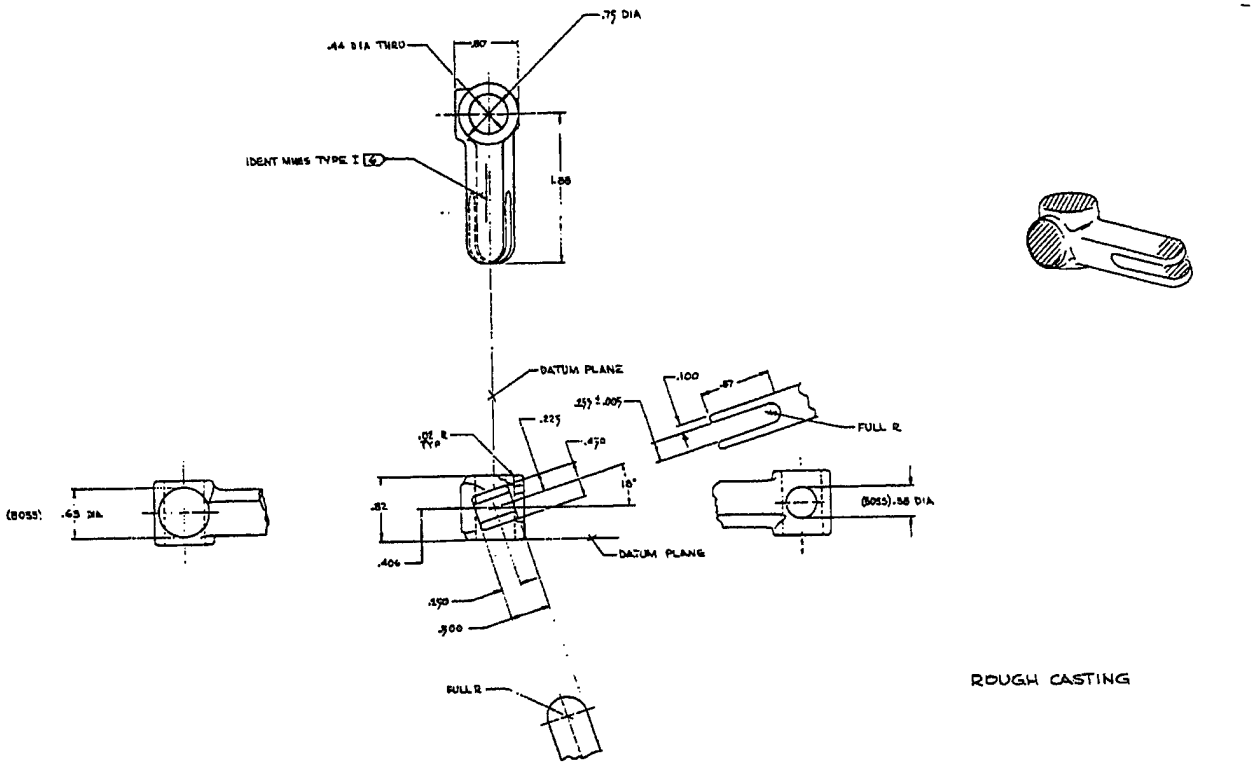




APPLYS TO MACHINED PART

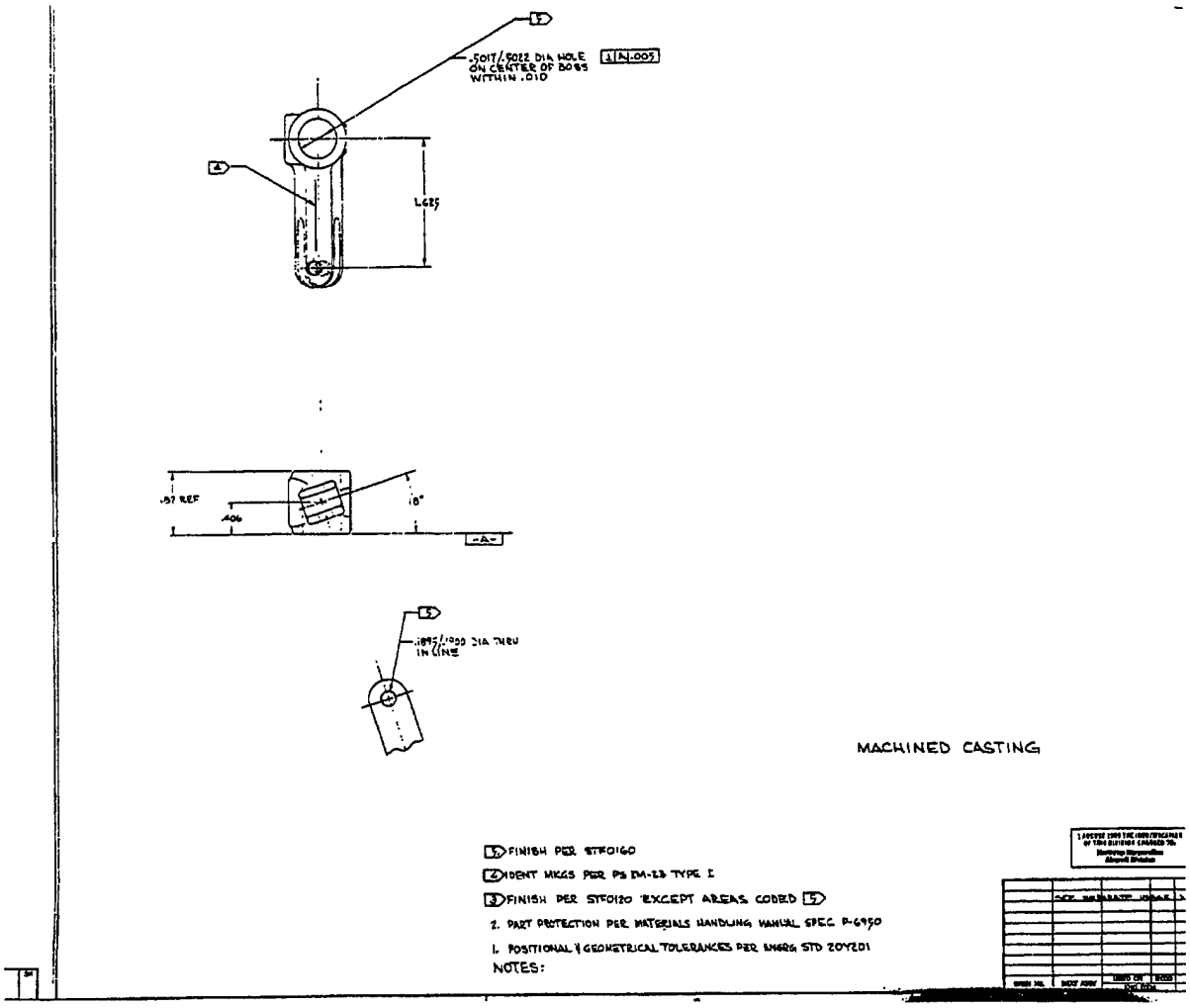
3. IDENT MKGS PER 11A-23 TYPE I
12. FINISH PER STD168
11. FINISH PER STD512 EXCEPT 12
10. MAXIMUM MISMATCH .02
9. POSITIONAL & GEOMETRICAL TOL PER ENGRG STD 20Y201
8. NOT LESS THAN .06 STOCK ON SURFACES TO BE MACHINED
7. CLASS I B CASTING PER MIL-C-6021
EXCEPT NONDESTRUCTIVE TESTING
PER PROCESS SPEC ZT-35
6. CASTING AND TOOLING POINTS TP SHALL
COMPLY WITH 6-07008
5. DRAFT ANGLE NOT TO EXCEED 0°30'
4. ALL CAST WEB THICKNESS N/A
3. ALL CAST CORNERS .015 R
2. ALL CAST FILLETS .050 R
1. TOLERANCE ON DIMENSIONS .X ± 0.1, .XX ± .02, .XXX ± .010, X° ± 1°
NOTES: UNLESS OTHERWISE SPECIFIED

12.3 Part 20 - Casting

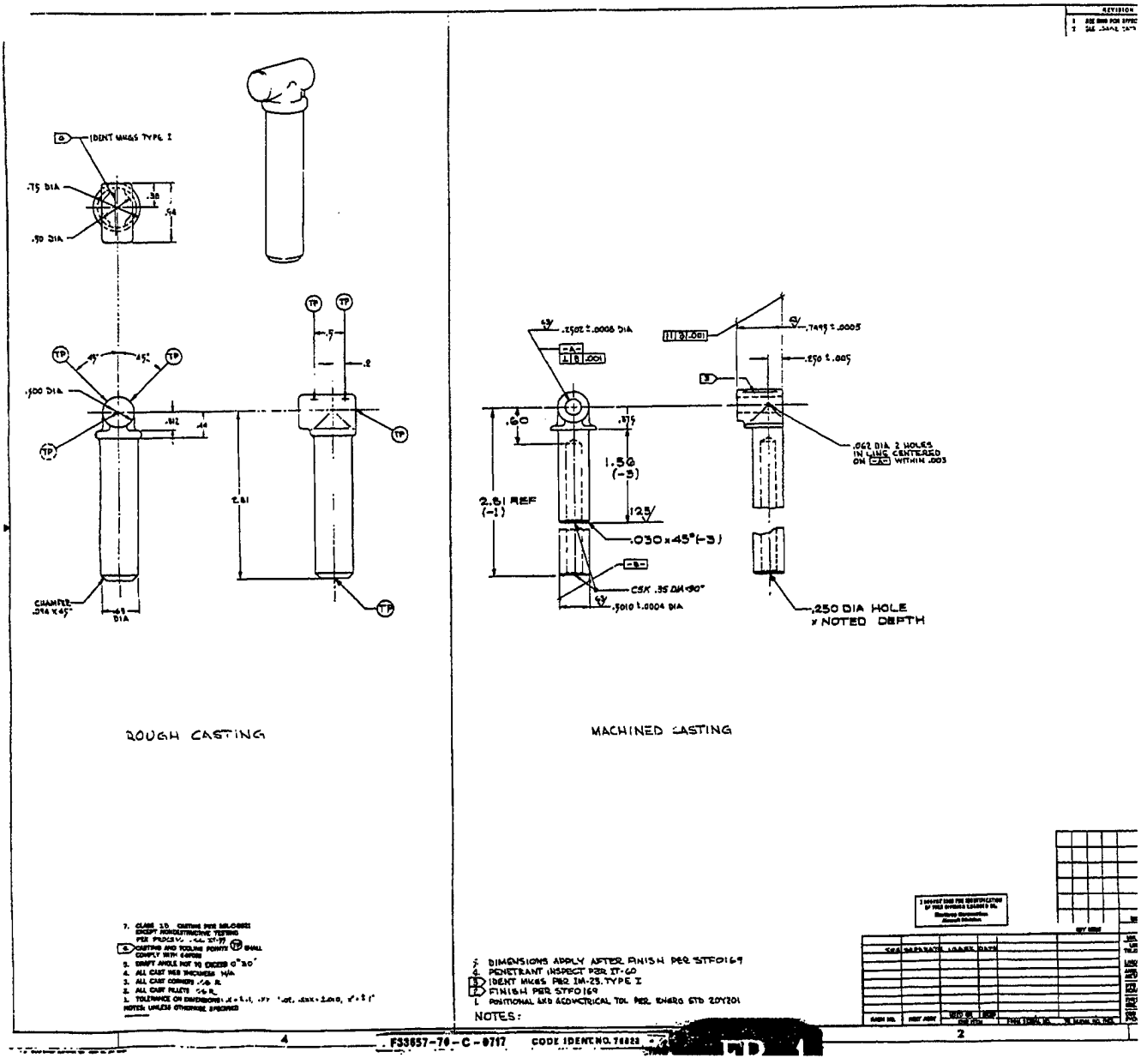


14

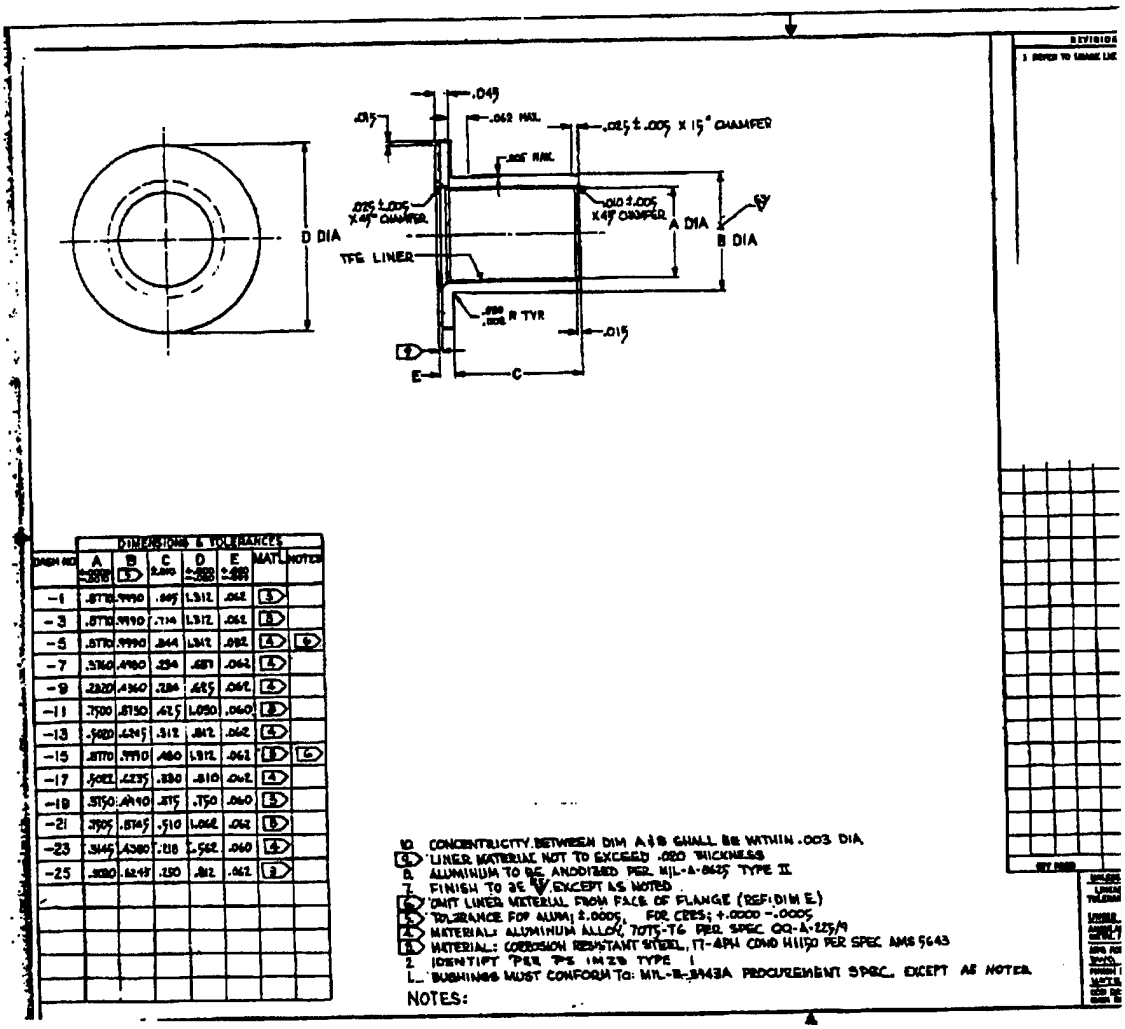
12.4 Part 20 - Machined Casting



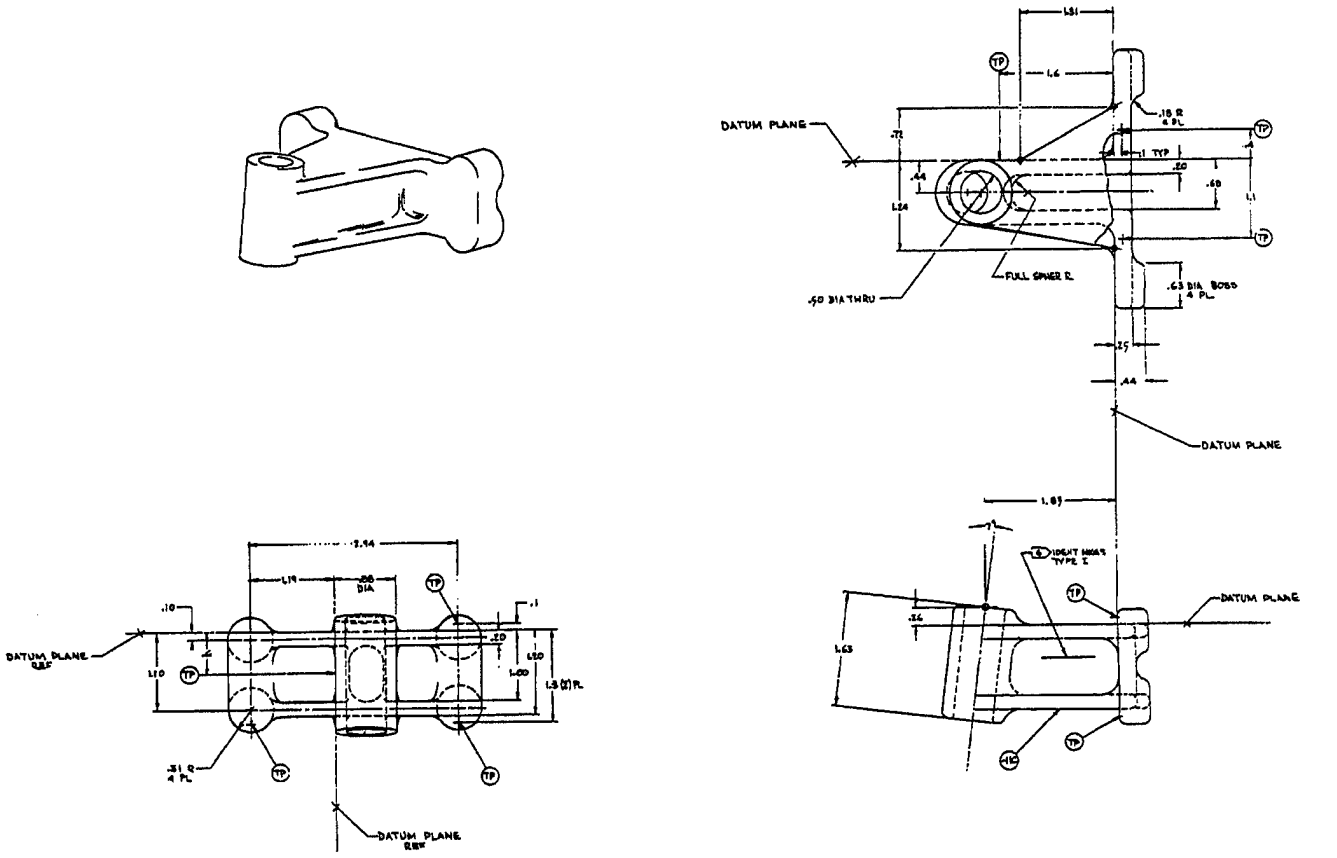
12.5 Part 21


IDENT MKGS TYPE I
.75 DIA
.50 DIA
.500 DIA
CHAMFER .094 X 45°
.63 DIA
2.81
.250Z ±.0005 DIA
.7499 ±.0005
.250 ±.005
.062 DIA 2 HOLES IN LUGS CENTERED ON A WITHIN .005
.60
1.50 (-3)
2.81 REF (-1)
125
.030 x 45° (-3)
CSK .35 DIA x 90°
.5010 ±.0004 DIA
.250 DIA HOLE x NOTED DEPTH
ROUGH CASTING
MACHINED CASTING
NOTES:
F33657-76-C-0717
CODE IDENT NO. 76828

12.6 Part 22

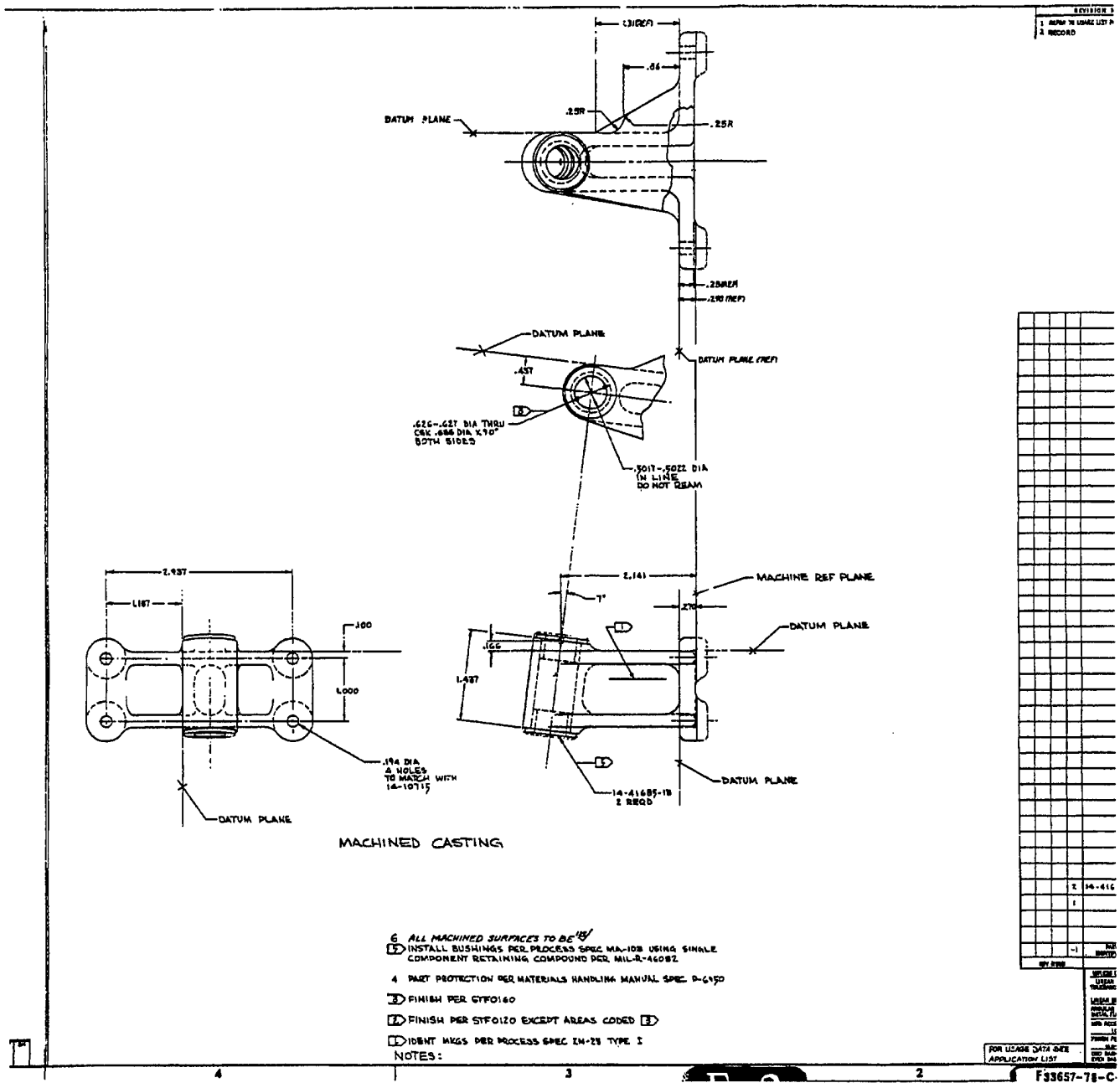

.049
.062 MAX.
.015
.025 ± .005 X 15° CHAMFER
.005 MAX.
.025 ± .005 X 45° CHAMFER
.010 ± .005 X 45° CHAMFER
A DIA
B DIA
D DIA
TFE LINER
.015 R TYP
.015
E
C
DIMENSIONS & TOLERANCES
DASH NO.
A
B
C
D
E
MATL
NOTES
-1 .8770 .9990 .609 1.312 .062 5
-3 .8770 .9990 .734 1.312 .062 5
-5 .8770 .9990 .844 1.312 .062 4 9
-7 .3760 .4980 .234 .687 .062 4
-9 .2820 .4360 .286 .625 .062 4
-11 .7500 .8750 .625 1.050 .060 3
-13 .5020 .6245 .312 .812 .062 4
-15 .8770 .9990 .480 1.312 .062 5 10
-17 .5002 .6235 .330 .810 .062 4
-19 .5750 .6990 .375 .750 .060 3
-21 .7505 .8745 .510 1.062 .062 5
-23 .3445 .4380 .118 .562 .060 4
-25 .2820 .6245 .150 .812 .062 3
10 CONCENTRICITY BETWEEN DIM A & B SHALL BE WITHIN .003 DIA.
9 LINER MATERIAL NOT TO EXCEED .020 THICKNESS
8 ALUMINUM TO BE ANODIZED PER MIL-A-8625 TYPE II
7 FINISH TO BE 32 EXCEPT AS NOTED
6 OMIT LINER MATERIAL FROM FACE OF FLANGE (REF: DIM E.)
5 TOLERANCE FOR ALUM: ±.0005, FOR CRES: +.0000 -.0005
4 MATERIAL: ALUMINUM ALLOY, 7075-T6 PER SPEC QQ-A-225/9
3 MATERIAL: CORROSION RESISTANT STEEL, 17-4PH COND H1150 PER SPEC AMS 5643
2 IDENTIFY PER MS 14128 TYPE I
1 BUSHINGS MUST CONFORM TO: MIL-B-8943A PROCUREMENT SPEC. EXCEPT AS NOTED.
NOTES:

12.7 Part 23 - Casting



14-41321

12.8 Part 23 - Machined Casting



13. APPENDIX B - IGES FILES

13.1 Part 15 - Intergraph

13.1.1 Parser Log - Basic IGES

```
 ************************************
 *****  IGES PARSER/VERIFIER   *****
 *****       MARCH 1993        *****
 *****   IGES Data Analysis    *****
 *****     (708) 344-1815      *****
 ************************************

 Input file is 7350016.igs

 Checking conformance to Standard IGES

 Today is January 14, 1994  12:22 AM

 ************************************
 *****    CHECK FILE SYNTAX    *****
 ************************************

    Section        Records

    Start              1
    Global             4
    Directory        602  (    301 Entities)
    Parameter        916
    Terminate          1

NITPICK 2489: Excess precision in real constant (17.894771575927734) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-4.809136920370412) for
              Coef.D     of D      5.
NITPICK 2489: Excess precision in real constant (0.153609820604324) for
              Coef.D     of D      7.
NITPICK 2489: Messages regarding excess precision suppressed.

 ************************************
 *****  SUMMARY AND STATISTICS  ****
 ************************************

 *** File and Product Name Information ***

    File name from sender     = '7350016.igs'
    File creation Date.Time   = '931001.144726'
    Model change Date.Time    = ''
    Author                    = 'Unspecified'
    Department                = 'Unspecified'
    Product name from sender  = 'EMS'
    Destination product name  = 'Unspecified'
```

```
*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'Intergraph Corp. EMS'
   Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
   Specification version = 9 (IGES 5.1)

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     7
   Double precision - Exponent =   308  Mantissa =    15

*** Global Model Data ***

   Model scale            =  1.0000E+00
   Unit flag              =  1
   Units                  =  'INCH'
   Line weights           =  32
   Maximum line thickness =  3.200000E+01
   Minimum line thickness =  1.000000E+00
   Granularity            =  1.000000E-06
   Maximum coordinate     =  1.789477E+01

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status: Visible                    287
               Blanked                     14

 Independence: Independent                 14
               Physically Subordinate     269
               Logically Subordinate       18
               Totally Subordinate          0

 Entity use:   Geometry                   240
               Annotation                  35
               Definition                   7
               Other                        0
               Logical/Positional           0
               2D parametric               19
               Construction geometry        0
               Not Specified                0

 Hierarchy:    Structure DE applies       260
               Subordinate DE applies      41
               Hierarchy property applies   0
               Not Specified                0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
102	0	0	30	Composite curve
102	0	2	3	
108	0	0	30	Plane, Unbounded
110	0	2	10	Line
110	0	3	1	
120	0	3	1	Surface of Revolution
122	0	3	5	Tabulated cylinder
124	0	0	5	Transformation matrix
126	0	0	162	Rational B-spline curve
128	0	3	2	Rational B-spline surface
128	2	3	3	Rational B-spline surface - Rgt circular cylinder
128	3	3	2	Rational B-spline surface - Cone
142	0	0	19	Curve on a parametric surface
144	0	3	15	Trimmed surface
402	7	0	2	Group without back-pointers instance
402	7	3	1	
406	15	0	5	Property - Name
410	0	0	5	View - Orthographic parallel

*** Entity Count by Level ***

Level	Count
0	258
2	13
3	30

*** Labeling Information ***

99% of the entities are labeled.

Unlabeled 3

Label	Count	Label	Count	Label	Count
VIEW	5	MATRIX	5	PLANE	30
PROPERTY	5	BS CURVE	154	TABSURF	5
MODEL CV	19	PARAM CV	19	CV_ON_SF	19
BOUND SF	15	LINE	11	SURFREV	1
BS SURF	7	COMP CRV	3		

```
*** Line Fonts Used in Data ***

100   102   104   106   108   110   112   114

 -     30    -     -     30    -     -     -    Undefined
 -      3    -     -     -     11    -     -    Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

116   118   120   122   124   125   126   128

 -     -     -     -      5    -     162   -    Undefined
 -     -      1     5    -     -     -      7   Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

130   132   134   136   138   140   142   144

 -     -     -     -     -     -     19    -    Undefined
 -     -     -     -     -     -     -     15   Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

*** Line Widths Used in Data ***

    Weight       Count      Width

 Defaulted       258       (1.0000)
      3           43       (3.0000)

*** Colors Used in Data ***

 Defaulted       258
      Cyan        43

************************************
*****     ENTITY ANALYSIS     *****
************************************

*** Entity type: 102

*** Entity type: 108

*** Entity type: 110

 --    11 lines averaging 4.394696E-01 units --
```

```
 *** Entity type: 120

 *** Entity type: 122

 *** Entity type: 124

5 transformation matrices, 4 non-zero translations.
NOTE    2341: 4 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

 *** Entity type: 142

 *** Entity type: 144

ERROR   2400: Curve at D    479 referenced by 142 (D    481) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    501 referenced by 142 (D    503) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    491 referenced by 142 (D    503) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    523 referenced by 142 (D    525) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    513 referenced by 142 (D    525) referenced by 144
              (D    527) is not closed.

 *** Entity type: 402

 *** Entity type: 406

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -0.198     XMAX =     0.198
   YMIN =    -0.154     YMAX =     0.154
   ZMIN =    -0.009     ZMAX =     1.289

CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     19.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =    -2.672     XMAX =     4.087
   YMIN =    -2.436     YMAX =     2.801
   ZMIN =    -0.396     ZMAX =     0.276
```

```
CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.

Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =     -0.444      XMAX =      0.608
   YMIN =     -0.067      YMAX =      0.748
   ZMIN =     -0.962      ZMAX =     -0.001

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     55.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =     -0.702      XMAX =      0.389
   YMIN =     -0.499      YMAX =      0.348
   ZMIN =      0.020      ZMAX =      0.333

CAUTION 2397: View at D     73 is not referenced by a drawing, orphan view.
              Scale of view at D     73 is 1.000000E+00.
Orthographic View entity at D     73 has  6 clipping planes specified.
   XMIN =     -4.809      XMAX =     -4.413
   YMIN =     -0.154      YMAX =      0.154
   ZMIN =      5.359      ZMAX =      6.406

 *** Message Summary ***

 *** Error Summary ***

     0 fatal errors
     0 severe errors
     5 errors
     0 warnings
     9 cautions
   666 nitpicks
     1 notes

 *** End of Analysis of 7350016.igs ***
```

13.1.2 Parser Log - CALS

```
**********************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
**********************************

Input file is 7350016.igs

Checking conformance to CALS Class IV (MIL-D-28000A 2/10/92)

Today is December 2, 1993  2:22 PM

**********************************
*****    CHECK FILE SYNTAX    *****
**********************************

   Section        Records

   Start              1
   Global             4
   Directory        602   (    301 Entities)
   Parameter        916
   Terminate          1

NITPICK 2489: Excess precision in real constant (17.894771575927734) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-4.809136920370412) for
              Coef.D     of D      5.
NITPICK 2489: Excess precision in real constant (0.153609820604324) for Coef.D
              of D      7.
NITPICK 2489: Messages regarding excess precision suppressed.

**********************************
*****  SUMMARY AND STATISTICS  ****
**********************************

*** File and Product Name Information ***

   File name from sender     = '7350016.igs'
   File creation Date.Time   = '931001.144726'
   Model change Date.Time    = ''
   Author                    = 'Unspecified'
   Department                = 'Unspecified'
   Product name from sender  = 'EMS'
   Destination product name  = 'Unspecified'

*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'
```

```
 *** Originating System Data ***

    System ID             = 'Intergraph Corp. EMS'
    Preprocessor version  = 'I/CIGES   02.02.01.01 24-Jun-93'
    Specification version = 9 (IGES 5.1)

ERROR   4048: Illegal specification version for CALS Class IV specified.

 *** Precision levels ***
    Integer bits =    32
    Floating point  -  Exponent =    38  Mantissa =     7
    Double precision - Exponent =   308  Mantissa =    15

 *** Global Model Data ***

    Model scale            =  1.0000E+00
    Unit flag              =  1
    Units                  =  'INCH'
    Line weights           =  32
    Maximum line thickness =  3.200000E+01
    Minimum line thickness =  1.000000E+00
    Granularity            =  1.000000E-06
    Maximum coordinate     =  1.789477E+01

    Drafting standard applicable to original data is not specified.

 *** Status Flag Summary ***

  Blank status: Visible                    287
                Blanked                     14

  Independence: Independent                 14
                Physically Subordinate     269
                Logically Subordinate       18
                Totally Subordinate          0

  Entity use:   Geometry                    240
                Annotation                   35
                Definition                    7
                Other                         0
                Logical/Positional            0
                2D parametric                19
                Construction geometry         0
                Not Specified                 0

  Hierarchy:    Structure DE applies        260
                Subordinate DE applies       41
                Hierarchy property applies    0
                Not Specified                 0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
102	0	0	30	Composite curve
102	0	2	3	
108	0	0	30	Plane, Unbounded
110	0	2	10	Line
110	0	3	1	
120	0	3	1	Surface of Revolution
122	0	3	5	Tabulated cylinder
124	0	0	5	Transformation matrix
126	0	0	162	Rational B-spline curve
128	0	3	2	Rational B-spline surface
128	2	3	3	Rational B-spline surface - Right circular cylinder
128	3	3	2	Rational B-spline surface - Cone
142	0	0	19	Curve on a parametric surface
144	0	3	15	Trimmed surface
402	7	0	2	Group without back-pointers instance
402	7	3	1	
406	15	0	5	Property - Name
410	0	0	5	View - Orthographic parallel

ERROR 4030: CALS Class IV requires that at least one drawing be defined.

*** Entity Count by Level ***

Level	Count
0	258
2	13
3	30

*** Labeling Information ***

99% of the entities are labeled.

Unlabeled 3

Label	Count	Label	Count	Label	Count
VIEW	5	MATRIX	5	PLANE	30
PROPERTY	5	BS CURVE	154	TABSURF	5
MODEL CV	19	PARAM CV	19	CV_ON_SF	19
BOUND SF	15	LINE	11	SURFREV	1
BS SURF	7	COMP CRV	3		

```
*** Line Fonts Used in Data ***

100   102   104   106   108   110   112   114

 -     30    -     -     30    -     -     -    Undefined
 -      3    -     -     -     11    -     -    Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

116   118   120   122   124   125   126   128

 -     -     -     -      5    -    162    -    Undefined
 -     -      1     5    -     -     -      7   Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

130   132   134   136   138   140   142   144

 -     -     -     -     -     -     19    -    Undefined
 -     -     -     -     -     -     -     15   Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

*** Line Widths Used in Data ***

    Weight       Count      Width

 Defaulted       258       (1.0000)
      3           43       (3.0000)

*** Colors Used in Data ***

 Defaulted       258
      Cyan        43

************************************
*****     ENTITY ANALYSIS      *****
************************************

*** Entity type: 102

ERROR   4046: Illegal line font for CALS Class IV specified in D    133.
ERROR   4046: Illegal line font for CALS Class IV specified in D    159.
ERROR   4046: Messages regarding illegal line fonts suppressed.
```

```
 *** Entity type: 108

ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D      5.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D      7.
ERROR   4044: Messages regarding hierarchy flags suppressed.

 *** Entity type: 110

  --    11 lines averaging 4.394696E-01 units --

 *** Entity type: 120

 *** Entity type: 122

 *** Entity type: 124

5 transformation matrices, 4 non-zero translations.
NOTE    2341: 4 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

ERROR   4042: Illegal form for CALS Class IV specified at D    397.
ERROR   4042: Illegal form for CALS Class IV specified at D    423.
ERROR   4042: Illegal form for CALS Class IV specified at D    449.
ERROR   4042: Illegal form for CALS Class IV specified at D    475.
ERROR   4042: Illegal form for CALS Class IV specified at D    529.

 *** Entity type: 142

 *** Entity type: 144

ERROR   2400: Curve at D    479 referenced by 142 (D    481) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    501 referenced by 142 (D    503) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    491 referenced by 142 (D    503) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    523 referenced by 142 (D    525) referenced by 144
              (D    527) is not closed.
ERROR   2400: Curve at D    513 referenced by 142 (D    525) referenced by 144
              (D    527) is not closed.

 *** Entity type: 402

 *** Entity type: 406

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
```

```
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =     -0.198      XMAX =      0.198
   YMIN =     -0.154      YMAX =      0.154
   ZMIN =     -0.009      ZMAX =      1.289

CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     19.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =     -2.672      XMAX =      4.087
   YMIN =     -2.436      YMAX =      2.801
   ZMIN =     -0.396      ZMAX =      0.276

CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =     -0.444      XMAX =      0.608
   YMIN =     -0.067      YMAX =      0.748
   ZMIN =     -0.962      ZMAX =     -0.001

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     55.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =     -0.702      XMAX =      0.389
   YMIN =     -0.499      YMAX =      0.348
   ZMIN =      0.020      ZMAX =      0.333

CAUTION 2397: View at D     73 is not referenced by a drawing, orphan view.
              Scale of view at D     73 is 1.000000E+00.
Orthographic View entity at D     73 has  6 clipping planes specified.
   XMIN =     -4.809      XMAX =     -4.413
   YMIN =     -0.154      YMAX =      0.154
   ZMIN =      5.359      ZMAX =      6.406

 *** Message Summary ***

4000: 1 Miscellaneous CALS messages
4011: 1 Problems in the Global section
4016: 243 Illegal line fonts
4019: 5 Entities with illegal form
4021: 250 Illegal hierarchy flags
```

```
 *** Error Summary ***

     0 fatal errors
     0 severe errors
   505 errors
     0 warnings
     9 cautions
   666 nitpicks
     1 notes

 *** End of Analysis of 7350016.igs ***
```

13.1.3 AutoCAD R12 Translation Log

```
Title: IGESIN Journal (v5.1 Nov 05 1992)
================================================================================
File: C:/IGESDEMO/7350016.xli
Date: Thu, Sep 09, 1993
Time: 11:16:57
================================================================================

EVALUATION VERSION -- NOT FOR RESALE

Translator S/N:   117-10075750
Translating from IGES file:        C:/IGESDEMO/7350016.IGS
            to AutoCAD Drawing:    C:\IGESDEMO\7350016.dwg

================================================================================

Options obtained from:  default settings
Curves Approximated to Tolerance of           0.01
Surfaces Approximated to Tolerance of         0.01

Text Font/Style mapping:
IGES Text font      Style Name       ACAD Font
         0                SYMBOL0         iges0
         1               STANDARD           txt
         2                  LEROY           txt
         3                FUTURA            txt
         6                COMP80            txt
        12               GOTHICE        gothice
        13               GOTHICI        gothici
        14                ROMANS         romans
        17                ROMANT         romant
        18                ROMAND         romand
        19                   OCR            txt
      1001               SYMBOL1       iges1001
      1002               SYMBOL2       iges1002
      1003               SYMBOL3       iges1003
      2001                 KANJI        bigfont
```

```
IGES Linefont/AutoCAD Linetype mapping
IGES Line Font      AutoCAD linetype        Shape file
         0                   BYLAYER
         1                 CONTINUOUS
         2                    DASHED             acad.lin
         3                   PHANTOM             acad.lin
         4                    CENTER             acad.lin
         5                       DOT             acad.lin

================================================================================

Parse phase

*** Warning (IAFP__LARGER_SGL_SIG) ***
C:/IGESDEMO/7350016.IGS, line 18: IGES file has greater number of significant
digits in single precision numbers than this system.

*** Warning (IEVM_BAD_PLANE_NORMAL_126) ***
(DE 119, TF 126:0) Normal for plane of curve is incorrect.

Action taken: Unit normal fixed.

*** Warning (IEVM_BAD_PLANE_NORMAL_126) ***
(DE 121, TF 126:0) Normal for plane of curve is incorrect.

Action taken: Unit normal fixed.

*** Warning (IEVM_BAD_PLANE_NORMAL_126) ***
(DE 137, TF 126:0) Normal for plane of curve is incorrect.

Action taken: Unit normal fixed.

                        <<<<< PART OF LOG REMOVED HERE >>>>>

*** Warning (IEVM_BAD_OUTER_CLOSED_CURVE_144) ***
(DE 495, TF 144:0) Entity has an outer trimming curve, DE 499 of type 142:0,
which is not closed.

*** Warning (IEVM_BAD_INNER_CLOSED_CURVE_144) ***
(DE 495, TF 144:0) Entity has a inner trimming curve, DE 505 of type 142:0,
which is not closed.

*** Warning (IEVM_BAD_INNER_CLOSED_CURVE_144) ***
(DE 495, TF 144:0) Entity has a inner trimming curve, DE 527 of type 142:0,
which is not closed.

*** Warning (IEVM_FIRST_NOT_COLINEAR_106) ***
(DE 1313, TF 106:40) Entity's points are not directionally colinear.  All
vectors formed by consecutive points must be in the same direction.

Action taken: First point moved to a valid location.

                        <<<<< PART OF LOG FILE REMOVED HERE >>>>>
```

```
*** Warning (IEVM_FIRST_NOT_COLINEAR_106) ***
(DE 1397, TF 106:40) Entity's points are not directionally colinear.  All
vectors formed by consecutive points must be in the same direction.

Action taken: First point moved to a valid location.

================================================================================
Start Section:

This file was produced by Intergraph Corporation's CIGES Translator
This  file  contains  illustrations  for  a
Geometry For NC Manufacture  in  MIL - D - 28000A
Class IV Form     -  Wed Sep  8 16:14:28 1993
PART_ID                    : 4-41349
DRAWING_ID                 : 4-41349
REVISION LETTER            :
PERFORMING ORGANIZATION    : Intergraph
Wed Sep  8 16:06:09 1993   Contract#
DRAWING SIZE               : B
DRAWING SHEETS             : 1
LEVEL    DESCRIPTION

Global Section:

Parameter Delimiter:       ,
Record Delimiter:          ;
Sending Product ID:        EMS
File Name:                 /usr/dayton/george/7350016.igs
System ID:                 Intergraph Corp. EMS
Preprocessor Version:      I/CIGES   02.02.01.01 24-Jun-93
Size of Integer:           32
Sgl. Precision Mag:        38
Sgl. Precision Sig:        7
Dbl. Precision Mag:        308
Dbl. Precision Sig:        15
Receiving Product ID:      Unspecified
Model Space Scale:         1.000000
Unit Flag:                 1
Unit String:               INCH
# of Line Weights:         32
Maximum Line Width:        32.000000
Creation Date:             09/08/93 16:14:16
Minimum Resolution:        0.000001
Maximum Coordinate:        17.894772
Author:                    Jeff Liffick
Organization:               Intergraph
IGES Version Number:       6
Drafting Standard:         0
```

Entity Summary:

Type	Form	Description	Count
102	0	Composite Curve	33
106	12	Piecewise Linear Curve	22
106	40	Witness Line	12
108	0	Plane (Unbounded)	54
110	0	Line	154
116	0	Point	8
120	0	Surface of Revolution	1
122	0	Tabulated Cylinder	5
124	0	Transformation Matrix	66
126	0	Rational B-Spline Curve (General)	276
128	0	Rational B-Spline Surface (General)	7
142	0	Curve on Parametric Surface	19
144	0	Trimmed (Parametric) Surface	15
210	0	General Label	2
212	0	General Note (Simple)	19
214	3	Leader (Filled triangle)	16
216	0	Linear dim - undetermined form	6
402	7	Group (Unordered, w/o back ptrs)	8
404	0	Drawing (form 0)	1
406	15	Property (Name)	10
406	16	Property (Drawing Size)	1
406	17	Property (Drawing Units)	1
410	0	View	9
		Total	745

Translation phase

*** Warning (IGEO_TRIMLOOPREORIENTED) ***
(DE: 111 TF: 144:0 NAME: Trimmed (Parametric) Surface)
The parametric curve(B) defining the outer surface trimming loop is oriented incorrectly. The parametric curve(B) will be reoriented for approximation.

<<<<< ***PART OF LOG REMOVED HERE*** >>>>>

*** Warning (IGEO_TRIMLOOPREORIENTED) ***
(DE: 549 TF: 144:0 NAME: Trimmed (Parametric) Surface)
The parametric curve(B) defining the outer surface trimming loop is oriented incorrectly. The parametric curve(B) will be reoriented for approximation.

Drawing Entity (404 Form 0) at DE 603, with
name = 7350016.dwg,
size = 17.000000, 6.891538,
units = INCH,
was processed in the AutoCAD drawing file: C:\IGESDEMO\7350016.dwg

*** Error (ACAD_ZEROLENGTHCURVE) ***
Curve length less than tolerance for DE: 1337, TYPE: 106, FORM: 40

```
*** Error (ACAD_ZEROLENGTHCURVE) ***
Curve length less than tolerance for DE:  1335, TYPE: 106, FORM: 40
```

IGES Entity Summary

Type	Form	Description	Count	Processed	Errors
102	0	Composite Curve	3	3	0
106	12	Piecewise Linear Curve	21	21	0
106	40	Witness Line	12	10	2
108	0	Plane (Unbounded)	54	54	0
110	0	Line	131	131	0
116	0	Point	8	8	0
126	0	Rational B-Spline Curve (General)	114	114	0
128	0	Rational B-Spline Surface (General)	1	1	0
144	0	Trimmed (Parametric) Surface	15	14	1
210	0	General Label	2	2	0
212	0	General Note (Simple)	13	13	0
214	3	Leader (Filled triangle)	16	16	0
216	0	Linear dim - undetermined form	6	6	0
402	7	Group (Unordered, w/o back ptrs)	8	8	0
404	0	Drawing (form 0)	1	1	0
406	15	Property (Name)	10	10	0
406	16	Property (Drawing Size)	1	1	0
406	17	Property (Drawing Units)	1	1	0
410	0	View	9	9	0
Totals			426	423	3

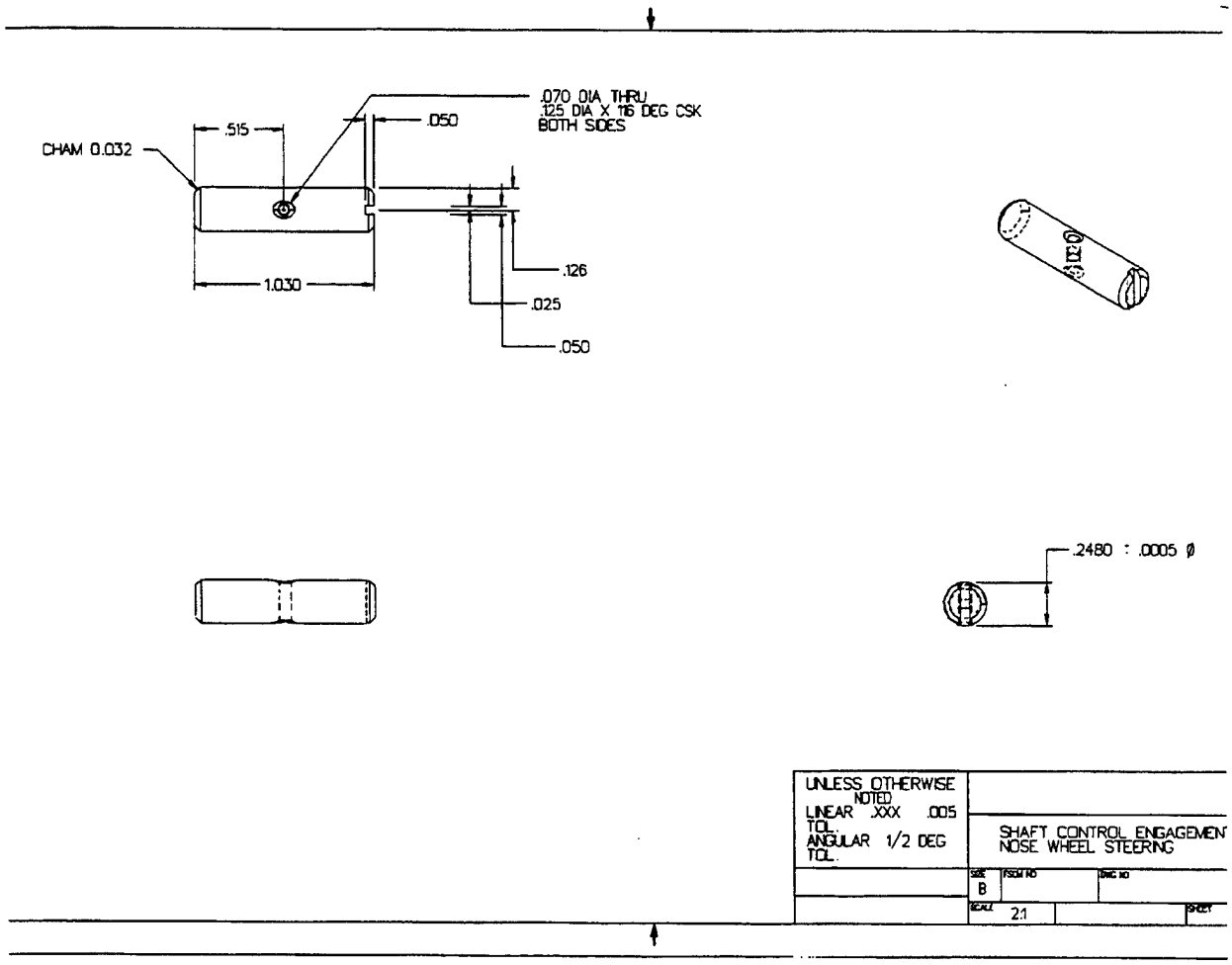
AutoCAD Entity Summary

Entity	Created	Errors
LINE	210	0
POINT	8	0
TEXT	16	0
SOLID	4	0
INSERT	6	0
POLYLINE	80	0
DIMENSION	6	0
BLOCK	6	0
Totals	336	0

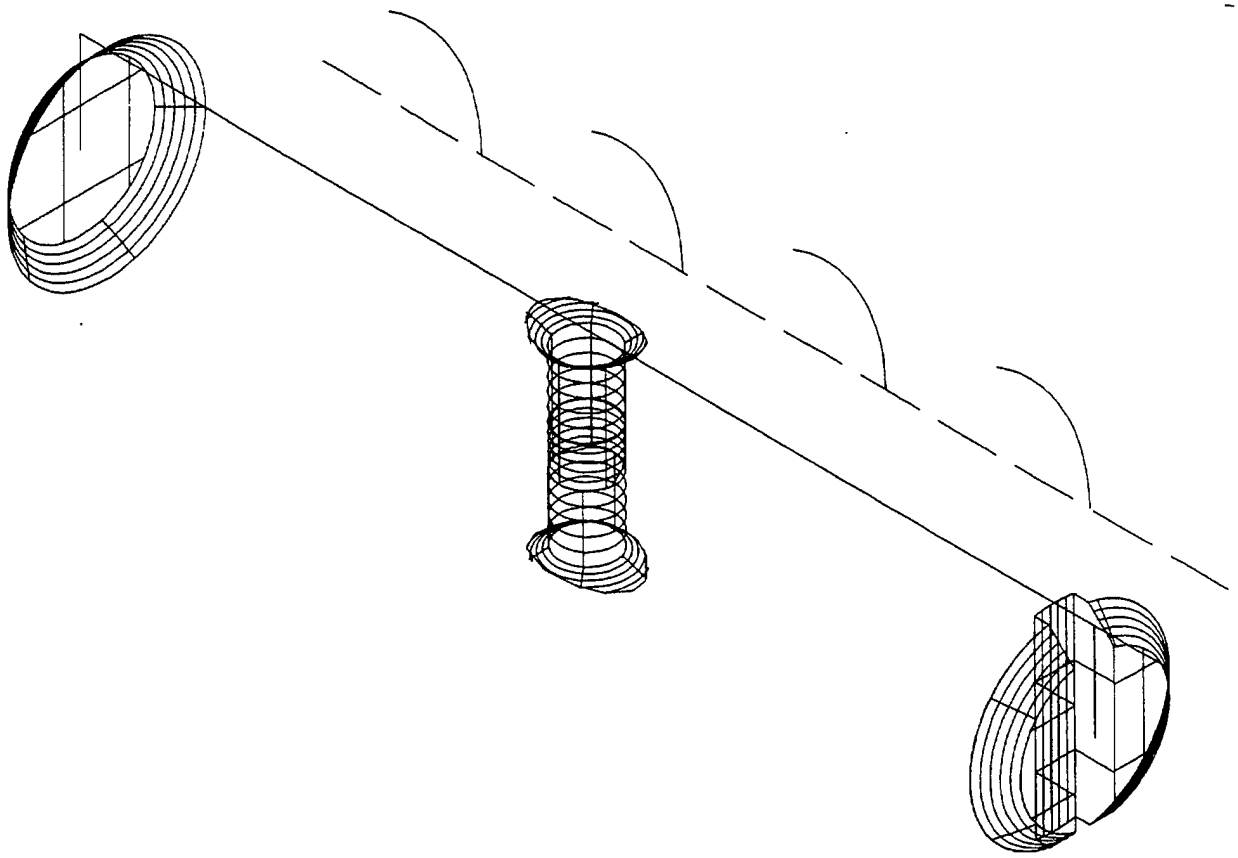
```
Error Summary:

The following message was issued 1 time(s)
IGES file has greater number of significant digits in single precision numbers
than this system.
```

```
The following message was issued 8 time(s)
Entity's points are not directionally colinear.  All vectors formed by
consecutive points must be in the same direction.

The following message was issued 154 time(s)
Normal for plane of curve is incorrect.

The following message was issued 1 time(s)
Entity has an outer trimming curve, DE %ld of type %<TF>, which is not closed.

The following message was issued 2 time(s)
Entity has a inner trimming curve, DE %ld of type %<TF>, which is not closed.

The following message was issued 14 time(s)
The parametric curve(B) defining the outer surface trimming loop is oriented
incorrectly.  The parametric curve(B) will be reoriented for approximation.

The following message was issued 2 time(s)
A parametric curve(B) defining an inner surface trimming loop is oriented
incorrectly.  The parametric curve(B) will be reoriented for approximation.

The following message was issued 2 time(s)
Curve length less than tolerance for DE:  June 13, 1994YPE: June 13, 1994ORM:
June 13, 1994

Status:  0
Warning: 182
Error:   2
Fatal:   0

Elapsed Time:

Processor: 00:00:21
Clock:   00:00:21
```

13.1.4 Output Drawing File



13.1.5 Output Model File



13.2 Part 16A

13.2.1 Advent Inc/AutoCAD R12

13.2.1.1 Parser Log - Basic IGES

```
**********************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
**********************************

Input file is det16e.igs

Checking conformance to Standard IGES

Today is January 18, 1994  11:18 AM

**********************************
*****    CHECK FILE SYNTAX    *****
**********************************

   Section        Records

   Start             17
   Global             5
   Directory       2726  (   1363 Entities)
   Parameter       4033
   Terminate          1

   No syntax errors detected.

**********************************
*****  SUMMARY AND STATISTICS  ****
**********************************

*** File and Product Name Information ***

   File name from sender     = 'C:\SCFILES\ADVENT\CALS\DET16E.igs'
   File creation Date.Time   = '931008.110746'
   Model change Date.Time    = '931008.110649'
   Author                    = 'author'
   Department                = 'organization'
   Product name from sender  = 'C:\SCFILES\ADVENT\CALS\DET16E'
   Destination product name  = 'C:\SCFILES\ADVENT\CALS\DET16E'

*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'
```

```
*** Originating System Data ***

   System ID              = 'AutoCAD-12 (386 DOS Extender)'
   Preprocessor version   = 'IGESOUT (v5.1.01 Feb 22 1993)'
   Specification version = 9 (IGES 5.1)

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     6
   Double precision - Exponent =    99  Mantissa =    15

*** Global Model Data ***

   Model scale            =  1.0000E+00
   Unit flag              =  1
   Units                  =  'IN'
   Line weights           =  32767
   Maximum line thickness =  3.276700E+01
   Minimum line thickness =  1.000000E-03
   Granularity            =  3.300000E-08
   Maximum coordinate     =  3.300000E+01

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status:  Visible                    1363
                Blanked                       0

 Independence:  Independent                1150
                Physically Subordinate      213
                Logically Subordinate         0
                Totally Subordinate           0

 Entity use:    Geometry                   1162
                Annotation                  194
                Definition                    7
                Other                         0
                Logical/Positional            0
                2D parametric                 0
                Construction geometry         0
                Not Specified                 0

 Hierarchy:     Structure DE applies       1327
                Subordinate DE applies       36
                Hierarchy property applies    0
                Not Specified                 0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	0	2	Circular arc
100	0	1	11	
100	0	2	11	
100	0	3	110	
100	0	6	2	
100	0	57	7	
100	0	58	56	
106	12	3	13	Copious data - Piecewise linear string (3D linear path)
106	12	21	21	
106	12	22	157	
106	12	23	89	
106	12	57	24	
106	12	58	39	
106	20	4	3	Centerline
106	40	4	31	Witness line
106	63	7	4	Simple closed planar curve
110	0	0	123	Line
110	0	1	3	
110	0	2	40	
110	0	3	165	
110	0	4	4	
110	0	5	2	
110	0	6	8	
110	0	7	10	
110	0	21	42	
110	0	22	20	
110	0	23	81	
110	0	57	53	
110	0	58	35	
116	0	1	2	Point
116	0	2	6	
116	0	4	1	
124	0	0	6	Transformation matrix
202	0	4	4	Angular dimension
206	0	4	1	Diameter dimension
212	0	0	35	General note
212	0	1	5	
212	0	4	26	
212	0	6	14	
212	0	7	4	
212	0	23	2	
212	2	4	8	General note - imbedded font change dimension
214	3	4	39	Leader arrow - Filled triangle
216	0	4	12	Linear dimension
222	0	4	6	Radius dimension
230	0	7	4	Sectioned area (Standard Crosshatching)
304	2	0	4	Line font definition - repeating pattern
308	0	0	3	Subfigure definition

406	3	0	1	Property - Level function
406	3	1	1	
406	3	2	1	
406	3	3	1	
406	3	4	1	
406	3	5	1	
406	3	6	1	
406	3	7	1	
406	3	21	1	
406	3	22	1	
406	3	23	1	
406	3	57	1	
406	3	58	1	
408	0	0	2	Single subfigure instance

*** Entity Count by Level ***

Level	Count
0	176
1	22
2	58
3	289
4	136
5	3
6	25
7	23
21	64
22	178
23	173
57	85
58	131

*** Labeling Information ***

0% of the entities are labeled.

Unlabeled 1359

Label	Count	Label	Count	Label	Count
BORDER	1	DASHDOT	1	DIVIDE	1
HIDDEN	1				

```
*** Line Fonts Used in Data ***

100   102   104   106   108   110   112   114

 -     -     -     -     -     -     -     -   Undefined
 89    -     -   364     -   409     -     -   Solid
 -     -     -     -     -     -     -     -   Dashed
 -     -     -     -     -     -     -     -   Phantom
 -     -     -     -     -     2     -     -   Center-line
 -     -     -     -     -     -     -     -   Dotted
110    -     -    17     -   175     -     -   User defined

116   118   120   122   124   125   126   128

 -     -     -     -     6     -     -     -   Undefined
  9    -     -     -     -     -     -     -   Solid
```

<<<<< *PART OF LOG REMOVED HERE* >>>>>

```
*** Line Widths Used in Data ***

    Weight       Count      Width

 Defaulted      1363       (0.0010)

*** Colors Used in Data ***

 Defaulted        26
       Red       257
     Green        59
      Blue       177
    Yellow       288
      Cyan        45
     White       511

************************************
*****     ENTITY ANALYSIS     *****
************************************

*** Entity type: 100

*** Entity type: 106

*** Entity type: 110

 --   586 lines averaging 1.171048E+00 units --

*** Entity type: 116

*** Entity type: 124

6 transformation matrices, 1 non-zero translations.
NOTE    2341: 1 matrices contain translation information.
```

```
 *** Entity type: 202

NOTE    2342: Zero witness line pointer at D   2321.

 *** Entity type: 206

 *** Entity type: 212

       120 text strings in data file.
       Average text aspect ratio in file is 0.8043678.
       Minimum text aspect ratio in file is 0.2083332.
       Maximum text aspect ratio in file is 1.0000000.

       FONTS USED IN FILE

       FONT   COUNT   NAME

          1     103   Default ASCII Style
       1003      17   Drafting Font

 *** Entity type: 214

       Average arrow aspect ratio in file is 3.0159159.
       Minimum arrow aspect ratio in file is 3.0000000.
       Maximum arrow aspect ratio in file is 3.0413813.

 *** Entity type: 216

 *** Entity type: 222

 *** Entity type: 230

 *** Entity type: 304

Default line font substitute at D      1 is Undefined.
Default line font substitute at D      3 is Undefined.
Default line font substitute at D      5 is Undefined.
Default line font substitute at D      7 is Undefined.

 *** Entity type: 308

  Subfigure name at D   2599: '*X80'.
    Number of included entities = 55.
  Subfigure name at D   2701: 'T-BLOCK'.
    Number of included entities = 49.
  Subfigure name at D   2725: 'D-SIZE'.
    Number of included entities = 10.
CAUTION 2398: Subfigure definition at D   2725 is not referenced by an
              instance
              entity.
```

```
 *** Entity type: 406

Independent property at D     11 applies to level 1.
Independent property at D     25 applies to level 3.
Independent property at D     45 applies to level 2.
Independent property at D    157 applies to level 21.
Independent property at D    285 applies to level 22.
Independent property at D    641 applies to level 23.
Independent property at D    983 applies to level 57.
Independent property at D   1377 applies to level 58.
Independent property at D   1869 applies to level 4.
Independent property at D   1897 applies to level 5.
Independent property at D   1925 applies to level 0.
Independent property at D   2011 applies to level 6.
Independent property at D   2189 applies to level 7.

 *** Entity type: 408

  Subfigure instance at D   2601 references subfigure at D   2599.
  Subfigure instance at D   2705 references subfigure at D   2701.

 *** Message Summary ***

 *** Error Summary ***

     0 fatal errors
     0 severe errors
     0 errors
     0 warnings
     1 cautions
     0 nitpicks
     2 notes

 *** End of Analysis of det16e.igs ***
```

13.2.1.2 Parser Log - CALS

```
**********************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
**********************************

Input file is det16e.igs

Checking conformance to CALS Class II (MIL-D-28000A 2/10/92)

Today is December 2, 1993  2:41 PM

**********************************
*****    CHECK FILE SYNTAX    *****
**********************************

   Section        Records

   Start             17
   Global             5
   Directory       2726  (   1363 Entities)
   Parameter       4033
   Terminate          1

   No syntax errors detected.

**********************************
*****  SUMMARY AND STATISTICS  ****
**********************************

*** File and Product Name Information ***

   File name from sender     = 'C:\SCFILES\ADVENT\CALS\DET16E.igs'
   File creation Date.Time   = '931008.110746'
   Model change Date.Time    = '931008.110649'
   Author                    = 'author'
   Department                = 'organization'
   Product name from sender  = 'C:\SCFILES\ADVENT\CALS\DET16E'
   Destination product name  = 'C:\SCFILES\ADVENT\CALS\DET16E'

*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'AutoCAD-12 (386 DOS Extender)'
   Preprocessor version   = 'IGESOUT (v5.1.01 Feb 22 1993)'
   Specification version = 9 (IGES 5.1)
```

```
ERROR   4048: Illegal specification version for CALS Class II specified.

 *** Precision levels ***
    Integer bits =    32
    Floating point  -  Exponent =    38  Mantissa =     6
    Double precision - Exponent =    99  Mantissa =    15

 *** Global Model Data ***

    Model scale            =  1.0000E+00
    Unit flag              =  1
    Units                  =  'IN'
    Line weights           =  32767
    Maximum line thickness =  3.276700E+01
    Minimum line thickness =  1.000000E-03
    Granularity            =  3.300000E-08
    Maximum coordinate     =  3.300000E+01

    Drafting standard applicable to original data is not specified.

 *** Status Flag Summary ***

  Blank status: Visible                    1363
                Blanked                       0

  Independence: Independent                1150
                Physically Subordinate      213
                Logically Subordinate         0
                Totally Subordinate           0

  Entity use:   Geometry                   1162
                Annotation                  194
                Definition                    7
                Other                         0
                Logical/Positional            0
                2D parametric                 0
                Construction geometry         0
                Not Specified                 0

  Hierarchy:    Structure DE applies       1327
                Subordinate DE applies       36
                Hierarchy property applies    0
                Not Specified                 0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	0	2	Circular arc
100	0	1	11	
100	0	2	11	
100	0	3	110	
100	0	6	2	
100	0	57	7	
100	0	58	56	
106	12	3	13	Copious data - Piecewise linear string (3D linear path)
106	12	21	21	
106	12	22	157	
106	12	23	89	
106	12	57	24	
106	12	58	39	
106	20	4	3	Centerline
106	40	4	31	Witness line
106	63	7	4	Simple closed planar curve
110	0	0	123	Line
110	0	1	3	
110	0	2	40	
110	0	3	165	
110	0	4	4	
110	0	5	2	
110	0	6	8	
110	0	7	10	
110	0	21	42	
110	0	22	20	
110	0	23	81	
110	0	57	53	
110	0	58	35	
116	0	1	2	Point
116	0	2	6	
116	0	4	1	
124	0	0	6	Transformation matrix
202	0	4	4	Angular dimension
206	0	4	1	Diameter dimension
212	0	0	35	General note
212	0	1	5	
212	0	4	26	
212	0	6	14	
212	0	7	4	
212	0	23	2	
212	2	4	8	General note - imbedded font change dimension
214	3	4	39	Leader arrow - Filled triangle
216	0	4	12	Linear dimension
222	0	4	6	Radius dimension
230	0	7	4	Sectioned area (Standard Crosshatching)
304	2	0	4	Line font definition - repeating pattern
308	0	0	3	Subfigure definition

406	3	0	1	Property - Level function
406	3	1	1	
406	3	2	1	
406	3	3	1	
406	3	4	1	
406	3	5	1	
406	3	6	1	
406	3	7	1	
406	3	21	1	
406	3	22	1	
406	3	23	1	
406	3	57	1	
406	3	58	1	
408	0	0	2	Single subfigure instance

ERROR 4030: CALS Class II requires that at least one drawing be defined.

*** Entity Count by Level ***

Level	Count
0	176
1	22
2	58
3	289
4	136
5	3
6	25
7	23
21	64
22	178
23	173
57	85
58	131

*** Labeling Information ***

0% of the entities are labeled.

Unlabeled 1359

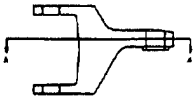
Label	Count	Label	Count	Label	Count
BORDER	1	DASHDOT	1	DIVIDE	1
HIDDEN	1				

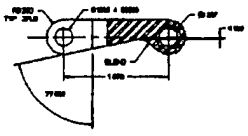
```
 *** Line Fonts Used in Data ***

 100   102   104   106   108   110   112   114

  -     -     -     -     -     -     -     -    Undefined
 89     -     -   364     -   409     -     -    Solid
  -     -     -     -     -     -     -     -    Dashed
  -     -     -     -     -     -     -     -    Phantom
  -     -     -     -     -     2     -     -    Center-line
  -     -     -     -     -     -     -     -    Dotted
110     -     -    17     -   175     -     -    User defined

 116   118   120   122   124   125   126   128

  -     -     -     -     6     -     -     -    Undefined
  9     -     -     -     -     -     -     -    Solid
  -     -     -     -     -     -     -     -    Dashed

                    <<<<< PART OF LOG REMOVED HERE >>>>>

 *** Line Widths Used in Data ***

     Weight       Count      Width

  Defaulted      1363       (0.0010)

 *** Colors Used in Data ***

  Defaulted        26
        Red       257
      Green        59
       Blue       177
     Yellow       288
       Cyan        45
      White       511

 ************************************
 *****      ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 100

 *** Entity type: 106

 *** Entity type: 110

  --    586 lines averaging 1.171048E+00 units --

 *** Entity type: 116

 *** Entity type: 124

6 transformation matrices, 1 non-zero translations.
NOTE    2341: 1 matrices contain translation information.
```

```
 *** Entity type: 202

NOTE    2342: Zero witness line pointer at D   2321.

 *** Entity type: 206

 *** Entity type: 212

       120 text strings in data file.
       Average text aspect ratio in file is 0.8043678.
       Minimum text aspect ratio in file is 0.2083332.
       Maximum text aspect ratio in file is 1.0000000.

       FONTS USED IN FILE

       FONT   COUNT   NAME

          1     103   Default ASCII Style
       1003      17   Drafting Font

 *** Entity type: 214

       Average arrow aspect ratio in file is 3.0159159.
       Minimum arrow aspect ratio in file is 3.0000000.
       Maximum arrow aspect ratio in file is 3.0413813.

 *** Entity type: 216

 *** Entity type: 222

 *** Entity type: 230

 *** Entity type: 304

Default line font substitute at D      1 is Undefined.
Default line font substitute at D      3 is Undefined.
Default line font substitute at D      5 is Undefined.
Default line font substitute at D      7 is Undefined.

 *** Entity type: 308

  Subfigure name at D   2599: '*X80'.
    Number of included entities = 55.
  Subfigure name at D   2701: 'T-BLOCK'.
    Number of included entities = 49.
  Subfigure name at D   2725: 'D-SIZE'.
    Number of included entities = 10.
CAUTION 2398: Subfigure definition at D   2725 is not referenced by an
              instance
              entity.
```

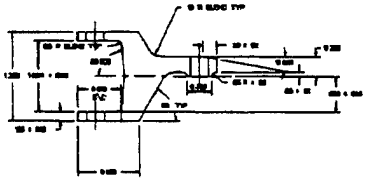
```
 *** Entity type: 406

Independent property at D     11 applies to level 1.
Independent property at D     25 applies to level 3.
Independent property at D     45 applies to level 2.
Independent property at D    157 applies to level 21.
Independent property at D    285 applies to level 22.
Independent property at D    641 applies to level 23.
Independent property at D    983 applies to level 57.
Independent property at D   1377 applies to level 58.
Independent property at D   1869 applies to level 4.
Independent property at D   1897 applies to level 5.
Independent property at D   1925 applies to level 0.
Independent property at D   2011 applies to level 6.
Independent property at D   2189 applies to level 7.

 *** Entity type: 408

  Subfigure instance at D   2601 references subfigure at D   2599.
  Subfigure instance at D   2705 references subfigure at D   2701.

 *** Message Summary ***

4000: 1 Miscellaneous CALS messages
4011: 1 Problems in the Global section

 *** Error Summary ***

     0 fatal errors
     0 severe errors
     2 errors
     0 warnings
     1 cautions
     0 nitpicks
     2 notes

 *** End of Analysis of det16e.igs ***
```

13.2.1.3 Output Drawing File





(SECTION "AA")



(SECTION 'BB')

13.2.2 Intergraph

13.2.2.1 Parser Log - Basic IGES

```
**********************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
**********************************

Input file is 7350020.igs

Checking conformance to Standard IGES

Today is February 7, 1994  10:16 AM

**********************************
*****    CHECK FILE SYNTAX    *****
**********************************

   Section        Records

   Start              1
   Global             4
   Directory       1218  (    609 Entities)
   Parameter       1618
   Terminate          1

NITPICK 2489: Excess precision in real constant (12.927976608276367) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-100.395355) for Mat[2][3]
              of D      3.
NITPICK 2489: Excess precision in real constant (2.302216622829437) for Coef.D
              of D      5.
NITPICK 2489: Messages regarding excess precision suppressed.

**********************************
*****  SUMMARY AND STATISTICS  ****
**********************************

*** File and Product Name Information ***

   File name from sender     = '7350020.igs'
   File creation Date.Time   = '930910.102428'
   Model change Date.Time    = ''
   Author                    = 'Unspecified'
   Department                = 'Unspecified'
   Product name from sender  = 'EMS'
   Destination product name  = 'Unspecified'
```

```
*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'Intergraph Corp. EMS'
   Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
   Specification version = 9 (IGES 5.1)

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     7
   Double precision - Exponent =   308  Mantissa =    15

*** Global Model Data ***

   Model scale            =  1.0000E+00
   Unit flag              =  1
   Units                  =  'INCH'
   Line weights           =  32
   Maximum line thickness =  3.200000E+01
   Minimum line thickness =  1.000000E+00
   Granularity            =  1.000000E-06
   Maximum coordinate     =  1.292798E+01

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status: Visible                    571
               Blanked                     38

 Independence: Independent                 37
               Physically Subordinate     537
               Logically Subordinate       35
               Totally Subordinate          0

 Entity use:   Geometry                   515
               Annotation                  41
               Definition                  14
               Other                        0
               Logical/Positional           0
               2D parametric               39
               Construction geometry        0
               Not Specified                0

 Hierarchy:    Structure DE applies       520
               Subordinate DE applies      89
               Hierarchy property applies   0
               Not Specified                0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	1	3	Circular arc
100	0	3	1	
100	0	20	1	
100	0	100	2	
102	0	0	62	Composite curve
102	0	1	1	
102	0	100	3	
106	40	3	2	Witness line
108	0	0	30	Plane, Unbounded
110	0	1	2	Line
110	0	100	16	
116	0	1	3	Point
116	0	3	3	
122	0	20	14	Tabulated cylinder
124	0	0	17	Transformation matrix
126	0	0	342	Rational B-spline curve
128	0	20	7	Rational B-spline surface
128	2	20	10	Rational B-spline surface - Right circular cylinder
142	0	0	39	Curve on a parametric surface
144	0	20	32	Trimmed surface
212	0	0	1	General note
214	3	3	2	Leader arrow - Filled triangle
216	0	3	1	Linear dimension
402	7	0	2	Group without back-pointers instance
402	7	20	1	
402	21	3	1	Dimensioned geometry
406	15	0	5	Property - Name
406	28	0	1	Property - Dimension units
410	0	0	5	View - Orthographic parallel

*** Entity Count by Level ***

Level	Count
0	504
1	9
3	10
20	65
100	21

*** Labeling Information ***

99% of the entities are labeled.

Unlabeled 4

Label	Count	Label	Count	Label	Count
VIEW	5	MATRIX	17	PLANE	30
PROPERTY	6	POINT	6	LINE	18
CIRARC	6	COMP CRV	4	BS CURVE	326
TABSURF	14	MODEL CV	39	PARAM CV	39
CV_ON_SF	39	BOUND SF	32	BS SURF	17
WITNESS	2	LIN LEAD	2	TEXT	1
ASC INST	1	CIRCLE	1		

*** Line Fonts Used in Data ***

100	102	104	106	108	110	112	114	
-	62	-	-	30	-	-	-	Undefined
7	4	-	2	-	18	-	-	Solid

<<<<< *PART OF LOG REMOVED HERE* >>>>>

-	-	-	-	17	-	342	-	Undefined
6	-	-	14	-	-	-	17	Solid

<<<<< *PART OF LOG REMOVED HERE* >>>>>

-	-	-	-	-	-	39	-	Undefined
-	-	-	-	-	-	-	32	Solid

<<<<< *PART OF LOG REMOVED HERE* >>>>>>

*** Line Widths Used in Data ***

Weight	Count	Width
Defaulted	503	(1.0000)
4	6	(4.0000)
3	93	(3.0000)
1	6	(1.0000)
2	1	(2.0000)

*** Colors Used in Data ***

Defaulted	503
Red	43
Yellow	10
Magenta	4
Cyan	49

```
**********************************
*****     ENTITY ANALYSIS     *****
**********************************

 *** Entity type: 100

 *** Entity type: 102

 *** Entity type: 106

 *** Entity type: 108

 *** Entity type: 110

  --    18 lines averaging 7.478040E-01 units --

 *** Entity type: 116

 *** Entity type: 122

 *** Entity type: 124

17 transformation matrices, 12 non-zero translations.
NOTE    2341: 12 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

 *** Entity type: 142

 *** Entity type: 144

 *** Entity type: 212

       1 text strings in data file.
       Average text aspect ratio in file is 0.5720020.
       Minimum text aspect ratio in file is 0.5720020.
       Maximum text aspect ratio in file is 0.5720020.

       FONTS USED IN FILE

       FONT    COUNT    NAME

          1        1    Default ASCII Style

 *** Entity type: 214

       Average arrow aspect ratio in file is 3.0233402.
       Minimum arrow aspect ratio in file is 3.0233402.
       Maximum arrow aspect ratio in file is 3.0233402.

 *** Entity type: 216
```

```
 *** Entity type: 402

 *** Entity type: 406

Independent property at D   1211 applies to level 0.

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -3.543     XMAX =     0.647
   YMIN =    -1.162     YMAX =     2.084
   ZMIN =  -200.395     ZMAX =    -0.395

CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =    -5.354     XMAX =    -3.639
   YMIN =    -1.290     YMAX =     0.040
   ZMIN =  -100.000     ZMAX =   100.000

CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =    -1.558     XMAX =     1.476
   YMIN =    -1.233     YMAX =     1.114
   ZMIN =  -105.171     ZMAX =    94.829

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     55.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =    -2.044     XMAX =     2.145
   YMIN =    -1.233     YMAX =     2.013
   ZMIN =   -99.881     ZMAX =   100.119

CAUTION 2397: View at D     73 is not referenced by a drawing, orphan view.
              Scale of view at D     73 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     73.
Orthographic View entity at D     73 has  6 clipping planes specified.
   XMIN =    -2.717     XMAX =     2.706
   YMIN =    -2.059     YMAX =     2.150
   ZMIN =  -205.301     ZMAX =    -5.301
```

```
 *** Message Summary ***

 *** Error Summary ***

     0 fatal errors
     0 severe errors
     0 errors
     0 warnings
     9 cautions
   834 nitpicks
     1 notes

 *** End of Analysis of 7350020.igs ***
```

13.2.2.2. Parser Log - CALS

```
 ***********************************
 *****  IGES PARSER/VERIFIER   *****
 *****       MARCH 1993        *****
 *****   IGES Data Analysis    *****
 *****     (708) 344-1815      *****
 ***********************************

 Input file is 7350020.igs

 Checking conformance to CALS Class IV (MIL-D-28000A 2/10/92)

 Today is February 7, 1994  10:14 AM

 ***********************************
 *****    CHECK FILE SYNTAX    *****
 ***********************************

    Section        Records

    Start              1
    Global             4
    Directory       1218  (    609 Entities)
    Parameter       1618
    Terminate          1

NITPICK 2489: Excess precision in real constant (12.927976608276367) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-100.395355) for Mat[2][3]
              of D      3.
NITPICK 2489: Excess precision in real constant (2.302216622829437) for Coef.D
              of D      5.
NITPICK 2489: Messages regarding excess precision suppressed.
```

```
**********************************
*****  SUMMARY AND STATISTICS  ****
**********************************

 *** File and Product Name Information ***

    File name from sender     = '7350020.igs'
    File creation Date.Time   = '930910.102428'
    Model change Date.Time    = ''
    Author                    = 'Unspecified'
    Department                = 'Unspecified'
    Product name from sender  = 'EMS'
    Destination product name  = 'Unspecified'

 *** Parameter Delimiters ***

    Delimiter  = ','
    Terminator = ';'

 *** Originating System Data ***

    System ID              = 'Intergraph Corp. EMS'
    Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
    Specification version = 9 (IGES 5.1)

ERROR   4048: Illegal specification version for CALS Class IV specified.

 *** Precision levels ***
    Integer bits =    32
    Floating point  -  Exponent =    38  Mantissa =     7
    Double precision - Exponent =   308  Mantissa =    15

 *** Global Model Data ***

    Model scale             =  1.0000E+00
    Unit flag               =  1
    Units                   =  'INCH'
    Line weights            =  32
    Maximum line thickness  =  3.200000E+01
    Minimum line thickness  =  1.000000E+00
    Granularity             =  1.000000E-06
    Maximum coordinate      =  1.292798E+01

    Drafting standard applicable to original data is not specified.
```

*** Status Flag Summary ***

Blank status:	Visible	571
	Blanked	38
Independence:	Independent	37
	Physically Subordinate	537
	Logically Subordinate	35
	Totally Subordinate	0
Entity use:	Geometry	515
	Annotation	41
	Definition	14
	Other	0
	Logical/Positional	0
	2D parametric	39
	Construction geometry	0
	Not Specified	0
Hierarchy:	Structure DE applies	520
	Subordinate DE applies	89
	Hierarchy property applies	0
	Not Specified	0

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	1	3	Circular arc
100	0	3	1	
100	0	20	1	
100	0	100	2	
102	0	0	62	Composite curve
102	0	1	1	
102	0	100	3	
106	40	3	2	Witness line
108	0	0	30	Plane, Unbounded
110	0	1	2	Line
110	0	100	16	
116	0	1	3	Point
116	0	3	3	
122	0	20	14	Tabulated cylinder
124	0	0	17	Transformation matrix
126	0	0	342	Rational B-spline curve
128	0	20	7	Rational B-spline surface
128	2	20	10	Rational B-spline surface - Right circular cylinder
142	0	0	39	Curve on a parametric surface
144	0	20	32	Trimmed surface
212	0	0	1	General note
214	3	3	2	Leader arrow - Filled triangle
216	0	3	1	Linear dimension
402	7	0	2	Group without back-pointers instance
402	7	20	1	

```
   402       21        3        1     Dimensioned geometry
   406       15        0        5     Property - Name
   406       28        0        1     Property - Dimension units
   410        0        0        5     View - Orthographic parallel

ERROR   4030: CALS Class IV requires that at least one drawing be defined.

 *** Entity Count by Level ***

    Level  Count
        0    504
        1      9
        3     10
       20     65
      100     21

 *** Labeling Information ***

   99% of the entities are labeled.

    Unlabeled       4

      Label       Count       Label       Count       Label       Count

       VIEW           5      MATRIX          17       PLANE          30
   PROPERTY           6       POINT           6        LINE          18
     CIRARC           6    COMP CRV           4    BS CURVE         326
    TABSURF          14    MODEL CV          39    PARAM CV          39
   CV_ON_SF          39    BOUND SF          32     BS SURF          17
    WITNESS           2    LIN LEAD           2        TEXT           1
   ASC INST           1      CIRCLE           1

 *** Line Fonts Used in Data ***

 100  102  104  106  108  110  112  114

  -    62   -    -    30   -    -    -   Undefined
   7    4   -     2   -    18   -    -   Solid

                        <<<<< PART OF LOG REMOVED HERE >>>>>

  -    -    -    -    17   -   342   -   Undefined
   6   -    -    14   -    -    -    17  Solid

                        <<<<< PART OF LOG REMOVED HERE  >>>>>

  -    -    -    -    -    -    39   -   Undefined
  -    -    -    -    -    -    -    32  Solid

                        <<<<< PART OF LOG REMOVED HERE >>>>>
```

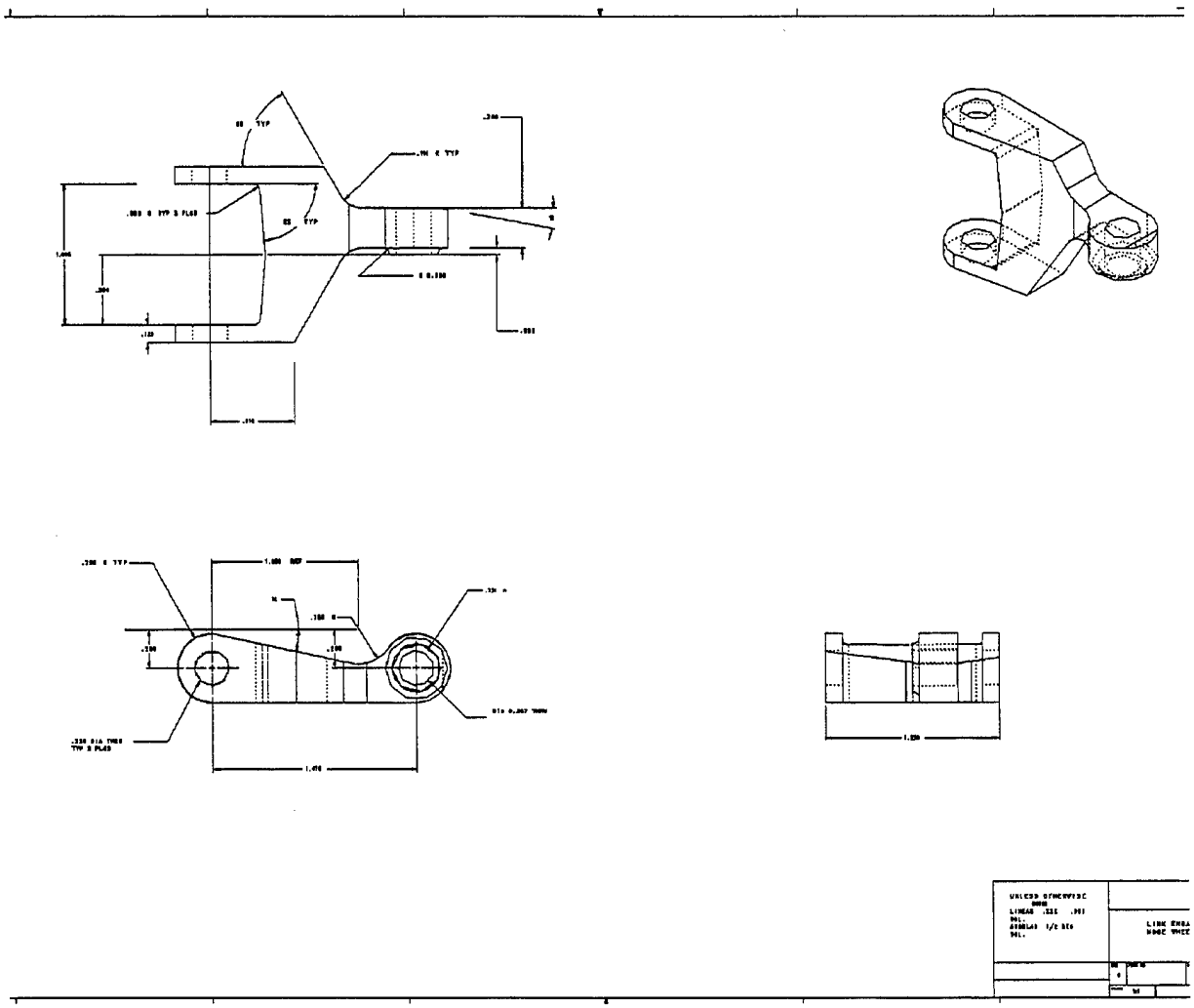
```
 *** Line Widths Used in Data ***

     Weight       Count      Width

  Defaulted       503       (1.0000)
       4            6       (4.0000)
       3           93       (3.0000)
       1            6       (1.0000)
       2            1       (2.0000)

 *** Colors Used in Data ***

  Defaulted       503
        Red        43
     Yellow        10
    Magenta         4
       Cyan        49

 ************************************
 *****      ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 100

ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D     99.
ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D    103.
ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D   1215.
ERROR    4046: Messages regarding illegal flag suppressed.

 *** Entity type: 102

ERROR    4046: Illegal line font for CALS Class IV specified in D    161.
ERROR    4046: Illegal line font for CALS Class IV specified in D    205.
ERROR    4046: Messages regarding illegal line fonts suppressed.

 *** Entity type: 106

 *** Entity type: 108

ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D      5.
ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D      7.
ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D      9.
ERROR    4044: Messages regarding hierarchy flags suppressed.

 *** Entity type: 110

  --     18 lines averaging 7.478040E-01 units --

 *** Entity type: 116

 *** Entity type: 122

 *** Entity type: 124
```

```
17 transformation matrices, 12 non-zero translations.
NOTE    2341: 12 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

ERROR   4042: Illegal form for CALS Class IV specified at D    211.
ERROR   4042: Illegal form for CALS Class IV specified at D    245.
ERROR   4046: Messages regarding illegal forms suppressed.

 *** Entity type: 142

 *** Entity type: 144

 *** Entity type: 212

       1 text strings in data file.
       Average text aspect ratio in file is 0.5720020.
       Minimum text aspect ratio in file is 0.5720020.
       Maximum text aspect ratio in file is 0.5720020.

       FONTS USED IN FILE

       FONT   COUNT   NAME

          1       1   Default ASCII Style

 *** Entity type: 214

ERROR   4025: CALS Class IV requires matrix pointer to be zero at D   1193.
ERROR   4008: CALS Class IV requires Z depth to be zero at D   1193.
ERROR   4025: CALS Class IV requires matrix pointer to be zero at D   1197.
ERROR   4008: CALS Class IV requires Z depth to be zero at D   1197.
       Average arrow aspect ratio in file is 3.0233402.
       Minimum arrow aspect ratio in file is 3.0233402.
       Maximum arrow aspect ratio in file is 3.0233402.

 *** Entity type: 216

 *** Entity type: 402

ERROR   4042: Messages regarding form numbers suppressed.

 *** Entity type: 406

Independent property at D   1211 applies to level 0.

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
```

```
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =     -3.543     XMAX =     0.647
   YMIN =     -1.162     YMAX =     2.084
   ZMIN =   -200.395     ZMAX =    -0.395

CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =     -5.354     XMAX =    -3.639
   YMIN =     -1.290     YMAX =     0.040
   ZMIN =   -100.000     ZMAX =   100.000

CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =     -1.558     XMAX =     1.476
   YMIN =     -1.233     YMAX =     1.114
   ZMIN =   -105.171     ZMAX =    94.829

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     55.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =     -2.044     XMAX =     2.145
   YMIN =     -1.233     YMAX =     2.013
   ZMIN =    -99.881     ZMAX =   100.119

CAUTION 2397: View at D     73 is not referenced by a drawing, orphan view.
              Scale of view at D     73 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     73.
Orthographic View entity at D     73 has  6 clipping planes specified.
   XMIN =     -2.717     XMAX =     2.706
   YMIN =     -2.059     YMAX =     2.150
   ZMIN =   -205.301     ZMAX =    -5.301

 *** Message Summary ***

4000: 1 Miscellaneous CALS messages
4007: 2 Non-zero Z depths
4011: 1 Problems in the Global section
4013: 2 Non-zero matrix pointers
4016: 475 Illegal line fonts
4019: 12 Entities with illegal form
4021: 497 Illegal hierarchy flags
```

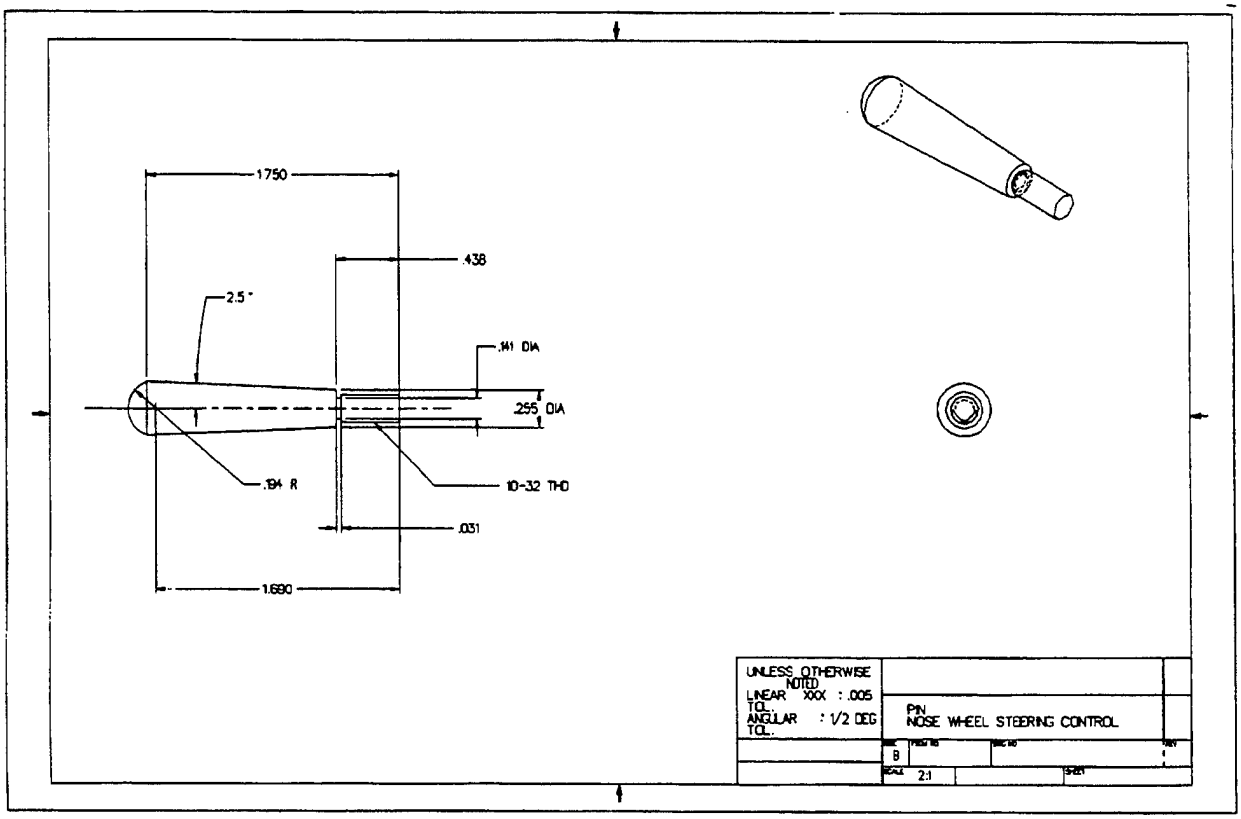
```
*** Error Summary ***

    0 fatal errors
    0 severe errors
  990 errors
    0 warnings
    9 cautions
  834 nitpicks
    1 notes

*** End of Analysis of 7350020.igs ***
```

13.2.2.3 Output Drawing File



13.3 Part 19

13.3.1 Output Drawing File



13.4 Part 20

13.4.1 Intergraph

13.4.1.1 Parser Log - Basic IGES

```
 ************************************
 *****  IGES PARSER/VERIFIER   *****
 *****       MARCH 1993        *****
 *****   IGES Data Analysis    *****
 *****     (708) 344-1815      *****
 ************************************

 Input file is 0020_dwg.igs

 Checking conformance to Standard IGES

 Today is January 14, 1994  12:22 AM

 ************************************
 *****    CHECK FILE SYNTAX    *****
 ************************************

    Section         Records

    Start              1
    Global             4
    Directory       2044  (   1022 Entities)
    Parameter       2288
    Terminate          1

NITPICK 2489: Excess precision in real constant (31.479961395263671) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-115.028132) for Mat[2][3]
              of D      3.
NITPICK 2489: Excess precision in real constant (-3.54004056930542) for Coef.D
              of D      5.
NITPICK 2489: Messages regarding excess precision suppressed.

 ************************************
 *****  SUMMARY AND STATISTICS  ****
 ************************************

 *** File and Product Name Information ***

    File name from sender     = '0020_dwg.igs'
    File creation Date.Time   = '930910.102440'
    Model change Date.Time    = ''
    Author                    = 'Unspecified'
    Department                = 'Unspecified'
    Product name from sender  = 'EMS'
    Destination product name  = 'Unspecified'
```

```
*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'Intergraph Corp. EMS'
   Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
   Specification version = 9 (IGES 5.1)

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     7
   Double precision - Exponent =   308  Mantissa =    15

*** Global Model Data ***

   Model scale             =  1.0000E+00
   Unit flag               =  1
   Units                   =  'INCH'
   Line weights            =  32
   Maximum line thickness  =  3.200000E+01
   Minimum line thickness  =  1.000000E+00
   Granularity             =  1.000000E-06
   Maximum coordinate      =  3.147996E+01

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status:  Visible                    1022
                Blanked                       0

 Independence:  Independent                 811
                Physically Subordinate       93
                Logically Subordinate       118
                Totally Subordinate           0

 Entity use:    Geometry                    820
                Annotation                  201
                Definition                    1
                Other                         0
                Logical/Positional            0
                2D parametric                 0
                Construction geometry         0
                Not Specified                 0

 Hierarchy:     Structure DE applies        908
                Subordinate DE applies      114
                Hierarchy property applies    0
                Not Specified                 0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	1	2	Circular arc
106	12	1	8	Copious data - Piecewise linear string (3D linear path)
106	12	1022	13	
106	12	1023	91	
106	40	1	16	Witness line
108	0	0	6	Plane, Unbounded
110	0	1	72	Line
110	0	1022	194	
110	0	1023	151	
124	0	0	109	Transformation matrix
126	0	1022	110	Rational B-spline curve
126	0	1023	98	
202	0	1	3	Angular dimension
206	0	1	1	Diameter dimension
210	0	1	1	General label
212	0	0	14	General note
212	0	1	43	
214	3	1	38	Leader arrow - Filled triangle
216	0	1	5	Linear dimension
222	0	1	4	Radius dimension
308	0	0	1	Subfigure definition
402	7	1	13	Group without back-pointers instance
402	21	1	13	Dimensioned geometry
406	15	0	1	Property - Name
406	28	0	13	Property - Dimension units
408	0	1	1	Single subfigure instance
410	0	0	1	View - Orthographic parallel

*** Entity Count by Level ***

Level	Count
0	145
1	220
1022	317
1023	340

```
*** Labeling Information ***

  98% of the entities are labeled.

   Unlabeled      13

     Label       Count       Label       Count       Label       Count

      VIEW           1      MATRIX         109       PLANE           6
  PROPERTY          14     LINESTR         112        LINE         417
      TEXT          57     SUB DEF           1    SUB INST           1
  ASC INST          26    BS CURVE         208    LIN LEAD          16
   WITNESS          16    ANG LEAD           6      LEADER          16
    CIRARC           2    GEN LABL           1

*** Line Fonts Used in Data ***

100   102   104   106   108   110   112   114

  -     -     -     -     6     -     -     -   Undefined
  2     -     -    37     -   265     -     -   Solid
  -     -     -     -     -     1     -     -   Dashed
  -     -     -     -     -     -     -     -   Phantom
  -     -     -     -     -     -     -     -   Center-line
  -     -     -    91     -   151     -     -   Dotted
  -     -     -     -     -     -     -     -   User defined

116   118   120   122   124   125   126   128

  -     -     -     -   109     -     -     -   Undefined
  -     -     -     -     -     -   110     -   Solid
  -     -     -     -     -     -     -     -   Dashed
  -     -     -     -     -     -     -     -   Phantom
  -     -     -     -     -     -     -     -   Center-line
  -     -     -     -     -     -    98     -   Dotted
```

<<<<< *PART OF LOG REMOVED HERE* >>>>>

```
*** Line Widths Used in Data ***

    Weight       Count      Width

 Defaulted         131      (1.0000)
      1            860      (1.0000)
      3              1      (3.0000)
      2             30      (2.0000)

*** Colors Used in Data ***

 Defaulted         131
       Red         375
     Green           7
    Yellow         323
   Magenta          10
      Cyan         176
```

```
 ************************************
 *****     ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 100

 *** Entity type: 106

 *** Entity type: 108

 *** Entity type: 110

CAUTION 2336: Zero length line at D    221.
CAUTION 2336: Zero length line at D    223.
CAUTION 2336: Messages regarding line length suppressed.
  --   417 lines averaging 6.302325E-01 units --

 *** Entity type: 124

109 transformation matrices, 70 non-zero translations.
NOTE    2341: 70 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 202

 *** Entity type: 206

 *** Entity type: 210

 *** Entity type: 212

       79 text strings in data file.
       Average text aspect ratio in file is 0.7607514.
       Minimum text aspect ratio in file is 0.4497120.
       Maximum text aspect ratio in file is 4.0000000.

       FONTS USED IN FILE

       FONT   COUNT   NAME

          1      74   Default ASCII Style
       1001       1   Symbol Font 1
       1003       4   Drafting Font

 *** Entity type: 214

       Average arrow aspect ratio in file is 3.0233402.
       Minimum arrow aspect ratio in file is 3.0233402.
       Maximum arrow aspect ratio in file is 3.0233402.

 *** Entity type: 216

 *** Entity type: 222
```

```
 *** Entity type: 308

  Subfigure name at D     201: 'Title block D,E,F,H,J,K Sizes'.
    Number of included entities = 21.

 *** Entity type: 402

 *** Entity type: 406

Independent property at D     243 applies to level 0.
Independent property at D     341 applies to level 0.
Independent property at D     357 applies to level 0.
Independent property at D     391 applies to level 0.
Independent property at D     421 applies to level 0.
Independent property at D     449 applies to level 0.
Independent property at D     465 applies to level 0.
Independent property at D    1551 applies to level 0.
Independent property at D    1565 applies to level 0.
Independent property at D    1593 applies to level 0.
Independent property at D    1761 applies to level 0.
Independent property at D    1965 applies to level 0.
Independent property at D    1991 applies to level 0.

 *** Entity type: 408

  Subfigure instance at D     203 references subfigure at D     201.

 *** Entity type: 410

CAUTION 2397: View at D       1 is not referenced by a drawing, orphan view.
              Scale of view at D       1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information at
              D       1.
Orthographic View entity at D       1 has  6 clipping planes specified.
   XMIN =    -12.617      XMAX =     23.423
   YMIN =    -13.826      YMAX =     14.923
   ZMIN =   -117.986      ZMAX =   -100.000

 *** Message Summary ***

2015: 30 Mathematically incorrect definitions.

 *** Error Summary ***

     0 fatal errors
     0 severe errors
     0 errors
     0 warnings
    32 cautions
  4148 nitpicks
     1 notes

 *** End of Analysis of 0020_dwg.igs ***
```

13.4.1.2 Parser Log - CALS

```
 ************************************
 *****  IGES PARSER/VERIFIER   *****
 *****       MARCH 1993        *****
 *****   IGES Data Analysis    *****
 *****     (708) 344-1815      *****
 ************************************

 Input file is 0020_dwg.igs

 Checking conformance to CALS Class IV (MIL-D-28000A 2/10/92)

 Today is December 2, 1993  2:20 PM

 ************************************
 *****    CHECK FILE SYNTAX    *****
 ************************************

    Section        Records

    Start             1
    Global            4
    Directory      2044  (   1022 Entities)
    Parameter      2288
    Terminate         1

NITPICK 2489: Excess precision in real constant (31.479961395263671) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-115.028132) for Mat[2][3]
              of D          3.
NITPICK 2489: Excess precision in real constant (-3.54004056930542) for Coef.D
              of D      5.
NITPICK 2489: Excess precision in real constant (23.689432579817061) for
              Coef.D    of D      7.
NITPICK 2489: Messages regarding excess precision suppressed.

 ************************************
 *****  SUMMARY AND STATISTICS  ****
 ************************************

 *** File and Product Name Information ***

    File name from sender    = '0020_dwg.igs'
    File creation Date.Time  = '930910.102440'
    Model change Date.Time   = ''
    Author                   = 'Unspecified'
    Department               = 'Unspecified'
    Product name from sender = 'EMS'
    Destination product name = 'Unspecified'
```

```
 *** Parameter Delimiters ***

    Delimiter  = ','
    Terminator = ';'

 *** Originating System Data ***

    System ID              = 'Intergraph Corp. EMS'
    Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
    Specification version = 9 (IGES 5.1)
ERROR   4048: Illegal specification version for CALS Class IV specified.

 *** Precision levels ***
    Integer bits =    32
    Floating point  -  Exponent =    38  Mantissa =     7
    Double precision - Exponent =   308  Mantissa =    15

 *** Global Model Data ***

    Model scale            =  1.0000E+00
    Unit flag              =  1
    Units                  =  'INCH'
    Line weights           =  32
    Maximum line thickness =  3.200000E+01
    Minimum line thickness =  1.000000E+00
    Granularity            =  1.000000E-06
    Maximum coordinate     =  3.147996E+01

    Drafting standard applicable to original data is not specified.

 *** Status Flag Summary ***

  Blank status: Visible                    1022
                Blanked                       0

  Independence: Independent                 811
                Physically Subordinate       93
                Logically Subordinate       118
                Totally Subordinate           0

  Entity use:   Geometry                    820
                Annotation                  201
                Definition                    1
                Other                         0
                Logical/Positional            0
                2D parametric                 0
                Construction geometry         0
                Not Specified                 0

  Hierarchy:    Structure DE applies        908
                Subordinate DE applies      114
                Hierarchy property applies    0
                Not Specified                 0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	1	2	Circular arc
106	12	1	8	Copious data - Piecewise linear string (3D linear path)
106	12	1022	13	
106	12	1023	91	
106	40	1	16	Witness line
108	0	0	6	Plane, Unbounded
110	0	1	72	Line
110	0	1022	194	
110	0	1023	151	
124	0	0	109	Transformation matrix
126	0	1022	110	Rational B-spline curve
126	0	1023	98	
202	0	1	3	Angular dimension
206	0	1	1	Diameter dimension
210	0	1	1	General label
212	0	0	14	General note
212	0	1	43	
214	3	1	38	Leader arrow - Filled triangle
216	0	1	5	Linear dimension
222	0	1	4	Radius dimension
308	0	0	1	Subfigure definition
402	7	1	13	Group without back-pointers instance
402	21	1	13	Dimensioned geometry
406	15	0	1	Property - Name
406	28	0	13	Property - Dimension units
408	0	1	1	Single subfigure instance
410	0	0	1	View - Orthographic parallel

ERROR 4030: CALS Class IV requires that at least one drawing be defined.

*** Entity Count by Level ***

Level	Count
0	145
1	220
1022	317
1023	340

*** Labeling Information ***

98% of the entities are labeled.

Unlabeled 13

Label	Count	Label	Count	Label	Count
VIEW	1	MATRIX	109	PLANE	6
PROPERTY	14	LINESTR	112	LINE	417
TEXT	57	SUB DEF	1	SUB INST	1
ASC INST	26	BS CURVE	208	LIN LEAD	16
WITNESS	16	ANG LEAD	6	LEADER	16
CIRARC	2	GEN LABL	1		

*** Line Fonts Used in Data ***

100	102	104	106	108	110	112	114	
-	-	-	-	6	-	-	-	Undefined
2	-	-	37	-	265	-	-	Solid
-	-	-	-	-	1	-	-	Dashed
-	-	-	-	-	-	-	-	Phantom
-	-	-	-	-	-	-	-	Center-line
-	-	-	91	-	151	-	-	Dotted
-	-	-	-	-	-	-	-	User defined

116	118	120	122	124	125	126	128	
-	-	-	-	109	-	-	-	Undefined
-	-	-	-	-	-	110	-	Solid
-	-	-	-	-	-	-	-	Dashed
-	-	-	-	-	-	-	-	Phantom
-	-	-	-	-	-	-	-	Center-line
-	-	-	-	-	-	98	-	Dotted
-	-	-	-	-	-	-	-	User defined

<<<<< ***PART OF LOG REMOVED HERE*** >>>>>

*** Line Widths Used in Data ***

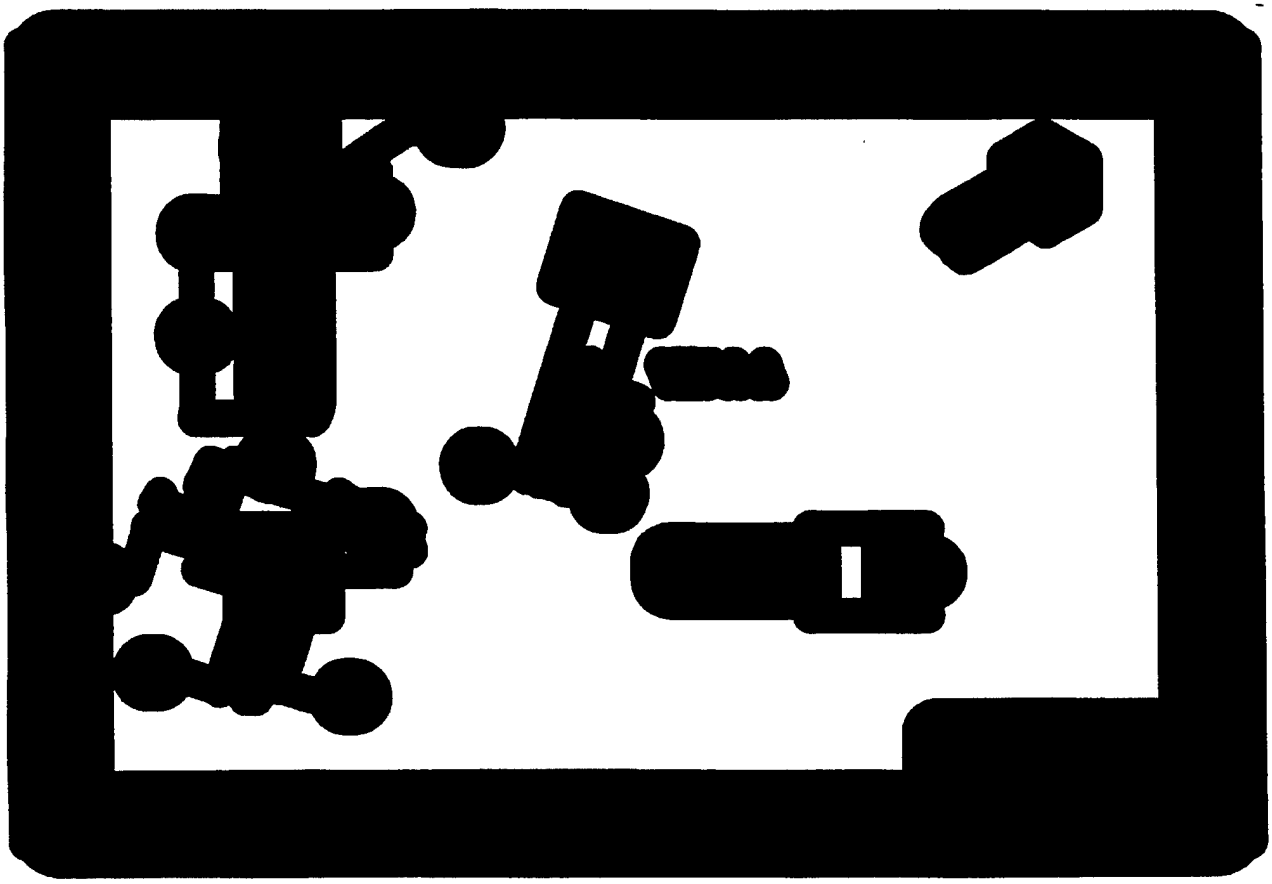
Weight	Count	Width
Defaulted	131	(1.0000)
1	860	(1.0000)
3	1	(3.0000)
2	30	(2.0000)

```
 *** Colors Used in Data ***

  Defaulted      131
        Red      375
      Green        7
     Yellow      323
    Magenta       10
       Cyan      176

 ***********************************
 *****     ENTITY ANALYSIS     *****
 ***********************************

 *** Entity type: 100

ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D   1337.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D   1341.

 *** Entity type: 106

ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D     19.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D     33.
ERROR   4044: Messages regarding hierarchy flags suppressed.

 *** Entity type: 108

ERROR   4046: Illegal line font for CALS Class IV specified in D      5.
ERROR   4046: Illegal line font for CALS Class IV specified in D      7.
ERROR   4046: Illegal line font for CALS Class IV specified in D      9.
ERROR   4046: Illegal line font for CALS Class IV specified in D     11.
ERROR   4046: Illegal line font for CALS Class IV specified in D     13.
ERROR   4046: Illegal line font for CALS Class IV specified in D     15.

 *** Entity type: 110

CAUTION 2336: Zero length line at D    221.
CAUTION 2336: Zero length line at D    223.
CAUTION 2336: Messages regarding line length suppressed.
  --   417 lines averaging 6.302325E-01 units --

 *** Entity type: 124

109 transformation matrices, 70 non-zero translations.
NOTE    2341: 70 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 202

 *** Entity type: 206

 *** Entity type: 210
```

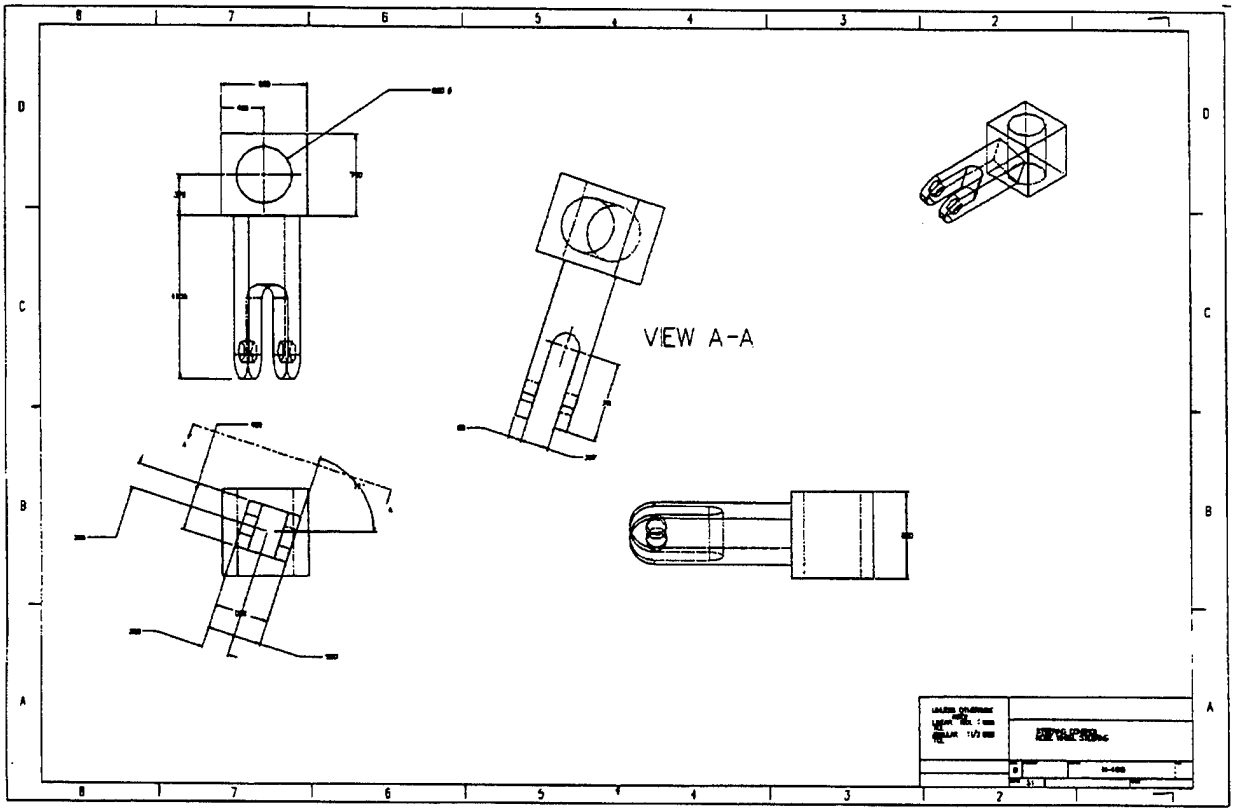
```
 *** Entity type: 212

       79 text strings in data file.
       Average text aspect ratio in file is 0.7607514.
       Minimum text aspect ratio in file is 0.4497120.
       Maximum text aspect ratio in file is 4.0000000.

       FONTS USED IN FILE

       FONT   COUNT   NAME

          1      74   Default ASCII Style
       1001       1   Symbol Font 1
       1003       4   Drafting Font

 *** Entity type: 214

ERROR   4025: CALS Class IV requires matrix pointer to be zero at D    231.
ERROR   4025: CALS Class IV requires matrix pointer to be zero at D    323.
ERROR   4025: Messages regarding non-zero matrix pointers suppressed.
ERROR   4049: Illegal subordinate flag for CALS Class IV specified
              at D    751.
ERROR   4049: Illegal subordinate flag for CALS Class IV specified
              at D   1083.
ERROR   4049: Messages regarding subordinate flags suppressed.
       Average arrow aspect ratio in file is 3.0233402.
       Minimum arrow aspect ratio in file is 3.0233402.
       Maximum arrow aspect ratio in file is 3.0233402.

 *** Entity type: 216

 *** Entity type: 222

 *** Entity type: 308

WARNING 4038: Entity type is not allowed in CALS Class IV.
  Subfigure name at D    201: 'Title block D,E,F,H,J,K Sizes'.
    Number of included entities = 21.

 *** Entity type: 402

ERROR   4042: Illegal form for CALS Class IV specified at D    239.
ERROR   4042: Illegal form for CALS Class IV specified at D    335.
ERROR   4042: Messages regarding form numbers suppressed.

 *** Entity type: 406

Independent property at D    243 applies to level 0.
Independent property at D    341 applies to level 0.

<<<<< PART OF LOG REMOVED HERE >>>>>
```

```
 *** Entity type: 408

WARNING 4038: Entity type is not allowed in CALS Class IV.
  Subfigure instance at D    203 references subfigure at D    201.

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =   -12.617     XMAX =    23.423
   YMIN =   -13.826     YMAX =    14.923
   ZMIN =  -117.986     ZMAX =  -100.000

 *** Message Summary ***

2015: 30 Mathematically incorrect definitions.
4000: 17 Miscellaneous CALS messages
4011: 1 Problems in the Global section
4013: 38 Non-zero matrix pointers
4016: 6 Illegal line fonts
4018: 2 Illegal entity types
4019: 26 Entities with illegal form
4021: 785 Illegal hierarchy flags

 *** Error Summary ***

     0 fatal errors
     0 severe errors
   873 errors
     2 warnings
    32 cautions
  4148 nitpicks
     1 notes

 *** End of Analysis of 0020_dwg.igs ***
```

13.4.1.3 Output - Line Thickness 32



13.4.1.4 Output - Normal Line Thickness



13.5 Part 20 - MQT/AutoSurf

13.5.1 Parser Log - Basic IGES

```
************************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
************************************

Input file is ct93.igs

Checking conformance to Standard IGES

Today is January 14, 1994  4:29 PM

************************************
*****    CHECK FILE SYNTAX    *****
************************************

   Section        Records

   Start              1
   Global             6
   Directory        374   (    187 Entities)
   Parameter        640
   Terminate          1

   No syntax errors detected.

************************************
*****  SUMMARY AND STATISTICS  ****
************************************

*** File and Product Name Information ***

   File name from sender     = 'ct93.IGS'
   File creation Date.Time   = '931004.130730'
   Model change Date.Time    = ''
   Author                    = ' NO AUTHOR'
   Department                = ' NO COMPANY'
   Product name from sender = ' MICRO ENGINEERING SOLUTIONS'
   Destination product name = ''

*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'
```

```
 *** Originating System Data ***

    System ID              = '-- SOLUTION 3000 -- Vers:5.3000'
    Preprocessor version   = ' MOD2IGES Vers: 5.20 '
    Specification version = 4 (IGES 3.0)

 *** Precision levels ***
    Integer bits =    16
    Floating point  -  Exponent =      8  Mantissa =     24
    Double precision - Exponent =      8  Mantissa =     56
NITPICK 2329: Real constant characteristics inconsistent with specification
              version.

 *** Global Model Data ***

    Model scale            =  1.0000E+00
    Unit flag              =  1
    Units                  =  'INCH'
    Line weights           =  0
NITPICK 2326: Number of line weights must be between 1 and 32768.
    Maximum line thickness =  0.000000E+00
CAUTION 2318: Maximum line thickness specified is zero.
    Minimum line thickness =  0.000000E+00
CAUTION 2317: Maximum line thickness equal to minimum thickness.
    Granularity            =  0.000000E+00
CAUTION 2319: Minimum intended resolution of 0.000000E+00 defaulted to 1.0E6.
    Maximum coordinate     =  0.000000E+00
CAUTION 2316: Maximum intended coordinate value of 0.000000E+00 will be
              defaulted to zero.

    Drafting standard applicable to original data is ANSI.

 *** Status Flag Summary ***

  Blank status: Visible                    187
                Blanked                      0

  Independence: Independent                167
                Physically Subordinate       0
                Logically Subordinate        0
                Totally Subordinate          0

  Entity use:   Geometry                   187
                Annotation                   0
                Definition                   0
                Other                        0
                Logical/Positional           0
                2D parametric                0
                Construction geometry       20
                Not Specified                0

  Hierarchy:    Structure DE applies       167
                Subordinate DE applies      20
                Hierarchy property applies   0
                Not Specified                0
```

```
*** Entity Occurrence Counts ***

 Entity    Form    Level     Count     Type
 ------    ----    -----     -----     ----

   100        0        1        20     Circular arc
   106       12        1        65     Copious data - Piecewise linear string
                                       (3D linear path)
   110        1        1        82     Entity unknown
   124        0        0        20     Transformation matrix

*** Entity Count by Level ***

   Level  Count
       0     20
       1    167

*** Labeling Information ***

 100% of the entities are labeled.

   Unlabeled       0

     Label       Count       Label       Count       Label       Count

 CIRCLE           20*  MATRIX           20*  LINE             82*
 COPIUS           65*

NITPICK 2327: One or more of the flagged entity labels are not
right-justified.

*** Line Fonts Used in Data ***

100  102  104  106  108  110  112  114

 -    -    -    -    -    -    -    -   Undefined
20    -    -   65    -   81    -    -   Solid
 -    -    -    -    -    -    -    -   Dashed
 -    -    -    -    -    -    -    -   Phantom
 -    -    -    -    -    1    -    -   Center-line
 -    -    -    -    -    -    -    -   Dotted
 -    -    -    -    -    -    -    -   User defined

116  118  120  122  124  125  126  128

 -    -    -    -   20    -    -    -   Undefined
 -    -    -    -    -    -    -    -   Solid
```

<<<<< ***PART OF LOG REMOVED HERE*** >>>>>

```
 *** Line Widths Used in Data ***

     Weight       Count      Width

  Defaulted       187       (0.0000)

 *** Colors Used in Data ***

  Defaulted        20
        Red        18
      Green        21
       Blue        34
    Magenta        11
       Cyan        11
      White        72

 ************************************
 *****     ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 100

 *** Entity type: 106

 *** Entity type: 110

  --     82 lines averaging 2.702682E-01 units --

 *** Entity type: 124

WARNING 2492: Undefined line font value (0) specified for D      3.
ERROR   2506: Undefined subordinate status (10) specified for D      3.
WARNING 2492: Undefined line font value (0) specified for D      7.
ERROR   2506: Undefined subordinate status (10) specified for D      7.
WARNING 2313: Improper definition space (defining vector magnitude not unit by
              4.354800E-06) at D     19.
WARNING 2492: Undefined line font value (0) specified for D     19.
ERROR   2506: Undefined subordinate status (10) specified for D     19.
WARNING 2492: Messages regarding undefined line font suppressed.
ERROR   2506: Messages regarding undefined subordinate status suppressed.

 *** Message Summary ***

2018: 3 Problems with line weight/width display information.
2038: 20 Invalid Line font values.
2043: 20 Invalid Subordinate status flags.
```

```
*** Error Summary ***

    0 fatal errors
    0 severe errors
   20 errors
   24 warnings
    4 cautions
    3 nitpicks
    1 notes

*** End of Analysis of ct93.igs ***
```

13.5.2 Parser Log - CALS

```
************************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
************************************

Input file is ct93.igs

Checking conformance to CALS Class II (MIL-D-28000A 2/10/92)

Today is December 2, 1993  2:40 PM

************************************
*****    CHECK FILE SYNTAX    *****
************************************

   Section        Records

   Start              1
   Global             6
   Directory        374   (    187 Entities)
   Parameter        640
   Terminate          1

   No syntax errors detected.

************************************
*****  SUMMARY AND STATISTICS  ****
************************************

*** File and Product Name Information ***

   File name from sender     = 'ct93.IGS'
   File creation Date.Time   = '931004.130730'
   Model change Date.Time    = ''
   Author                    = ' NO AUTHOR'
   Department                = ' NO COMPANY'
   Product name from sender  = ' MICRO ENGINEERING SOLUTIONS'
   Destination product name  = ''
```

```
 *** Parameter Delimiters ***

    Delimiter  = ','
    Terminator = ';'

 *** Originating System Data ***

    System ID              = '-- SOLUTION 3000 -- Vers:5.3000'
    Preprocessor version   = ' MOD2IGES Vers: 5.20 '
    Specification version = 4 (IGES 3.0)

 *** Precision levels ***
    Integer bits =    16
    Floating point  -  Exponent =     8  Mantissa =    24
    Double precision - Exponent =     8  Mantissa =    56
NITPICK 2329: Real constant characteristics inconsistent with specification
              version.

 *** Global Model Data ***

    Model scale            =  1.0000E+00
    Unit flag              =  1
    Units                  =  'INCH'
    Line weights           =  0
ERROR   4067: CALS Class II does not allow line weights to be defaulted.
NITPICK 2326: Number of line weights must be between 1 and 32768.
    Maximum line thickness =  0.000000E+00
ERROR   4069: CALS Class II does not allow maximum thickness to be defaulted.
CAUTION 2318: Maximum line thickness specified is zero.
    Minimum line thickness =  0.000000E+00
CAUTION 2317: Maximum line thickness equal to minimum thickness.
    Granularity            =  0.000000E+00
ERROR   4066: CALS Class II does not allow granularity to be defaulted.
CAUTION 2319: Minimum intended resolution of 0.000000E+00 defaulted to 1.0E6.
    Maximum coordinate     =  0.000000E+00
CAUTION 2316: Maximum intended coordinate value of 0.000000E+00 will be
              defaulted to zero.

    Drafting standard applicable to original data is ANSI.

 *** Status Flag Summary ***

  Blank status: Visible                    187
                Blanked                      0

  Independence: Independent                167
                Physically Subordinate       0
                Logically Subordinate        0
                Totally Subordinate          0
```

Entity use:	Geometry	187
	Annotation	0
	Definition	0
	Other	0
	Logical/Positional	0
	2D parametric	0
	Construction geometry	20
	Not Specified	0
Hierarchy:	Structure DE applies	167
	Subordinate DE applies	20
	Hierarchy property applies	0
	Not Specified	0

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	1	20	Circular arc
106	12	1	65	Copious data - Piecewise linear string (3D linear path)
110	1	1	82	Entity unknown
124	0	0	20	Transformation matrix

ERROR 4030: CALS Class II requires that at least one drawing be defined.

*** Entity Count by Level ***

Level	Count
0	20
1	167

*** Labeling Information ***

100% of the entities are labeled.

Unlabeled 0

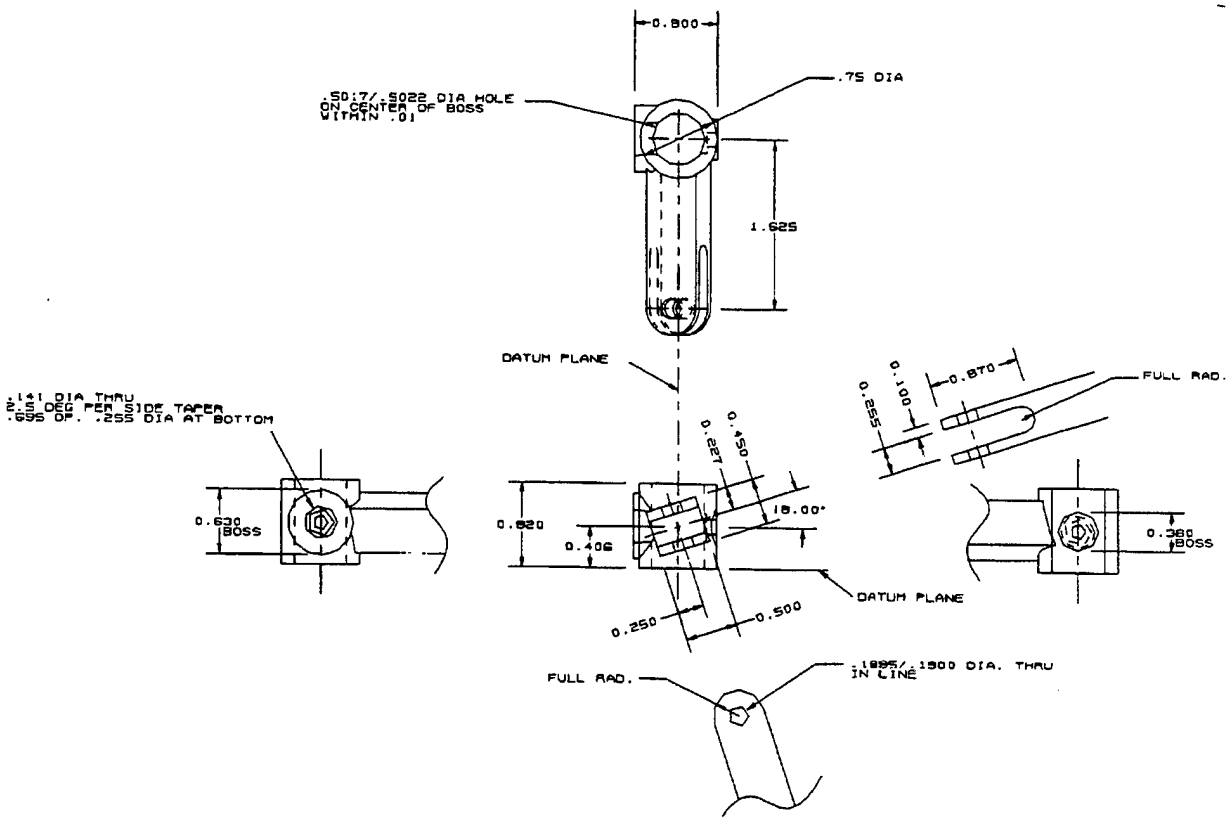
Label	Count	Label	Count	Label	Count
CIRCLE	20*	MATRIX	20*	LINE	82*
COPIUS	65*				

NITPICK 2327: One or more of the flagged entity labels are not right-justified.

```
 *** Line Fonts Used in Data ***

 100   102   104   106   108   110   112   114

  -     -     -     -     -     -     -     -    Undefined
 20     -     -    65     -    81     -     -    Solid
  -     -     -     -     -     -     -     -    Dashed
  -     -     -     -     -     -     -     -    Phantom
  -     -     -     -     -     1     -     -    Center-line
  -     -     -     -     -     -     -     -    Dotted
  -     -     -     -     -     -     -     -    User defined

 116   118   120   122   124   125   126   128

  -     -     -     -    20     -     -     -    Undefined
  -     -     -     -     -     -     -     -    Solid

                  <<<<< PART OF LOG REMOVED HERE >>>>>

 *** Line Widths Used in Data ***

     Weight       Count      Width

  Defaulted       187       (0.0000)

 *** Colors Used in Data ***

  Defaulted        20
        Red        18
      Green        21
       Blue        34
    Magenta        11
       Cyan        11
      White        72

 ************************************
 *****     ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 100

 *** Entity type: 106

 *** Entity type: 110

  --     82 lines averaging 2.702682E-01 units --

 *** Entity type: 124

WARNING 2492: Undefined line font value (0) specified for D      3.
ERROR   2506: Undefined subordinate status (10) specified for D      3.
WARNING 2492: Undefined line font value (0) specified for D      7.
ERROR   2506: Undefined subordinate status (10) specified for D      7.
WARNING 2313: Improper definition space (defining vector magnitude not unit by
              4.354800E-06) at D     19.
```

```
WARNING 2492: Undefined line font value (0) specified for D     19.
ERROR   2506: Undefined subordinate status (10) specified for D     19.
WARNING 2492: Undefined line font value (0) specified for D     25.
ERROR   2506: Undefined subordinate status (10) specified for D     25.
WARNING 2313: Improper definition space (defining vector magnitude not unit by
              6.826249E-06) at D     35.
WARNING 2492: Undefined line font value (0) specified for D     35.
ERROR   2506: Undefined subordinate status (10) specified for D     35.
WARNING 2313: Improper definition space (defining vector magnitude not unit by
              3.192978E-06) at D     39.
WARNING 2492: Messages regarding undefined line font suppressed.
ERROR   2506: Messages regarding undefined subordinate status suppressed.
WARNING 2313: Improper definition space (defining vector magnitude not unit by
              6.647416E-06) at D     95.
20 transformation matrices, 18 non-zero translations.
NOTE    2341: 18 matrices contain translation information.

 *** Message Summary ***

2018: 3 Problems with line weight/width display information.
2038: 20 Invalid Line font values.
2043: 20 Invalid Subordinate status flags.
4000: 1 Miscellaneous CALS messages
4031: 3 Illegally defaulted global values.

 *** Error Summary ***

     0 fatal errors
     0 severe errors
    24 errors
    24 warnings
     4 cautions
     3 nitpicks
     1 notes

 *** End of Analysis of ct93.igs ***
```

13.5.3 Output Drawing File



13.6 Part 21 - Intergraph

13.6.1 Parser Log - Basic IGES

```
 ************************************
 *****  IGES PARSER/VERIFIER   *****
 *****       MARCH 1993        *****
 *****   IGES Data Analysis    *****
 *****     (708) 344-1815      *****
 ************************************

 Input file is 7350010.igs

 Checking conformance to Standard IGES

 Today is January 14, 1994  12:48 AM

 ************************************
 *****    CHECK FILE SYNTAX    *****
 ************************************

    Section        Records

    Start             1
    Global            3
    Directory       694  (    347 Entities)
    Parameter      1786
    Terminate         1

NITPICK 2489: Excess precision in real constant (4.846409797668457) for
MaxValue
              of Global Section.
NITPICK 2489: Excess precision in real constant (-3.464063646197319) for
Coef.D
              of D      5.
NITPICK 2489: Messages regarding excess precision suppressed.

 ************************************
 *****  SUMMARY AND STATISTICS  ****
 ************************************

 *** File and Product Name Information ***

    File name from sender    = '7350010.igs'
    File creation Date.Time  = '931007.103807'
    Model change Date.Time   = ''
    Author                   = 'Unspecified'
    Department               = 'Unspecified'
    Product name from sender = 'EMS'
    Destination product name = 'Unspecified'
```

```
*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'Intergraph Corp. EMS'
   Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
   Specification version = 9 (IGES 5.1)

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     7
   Double precision - Exponent =   308  Mantissa =    15

*** Global Model Data ***

   Model scale            =  1.0000E+00
   Unit flag              =  1
   Units                  =  'INCH'
   Line weights           =  32
   Maximum line thickness =  3.200000E+01
   Minimum line thickness =  1.000000E+00
   Granularity            =  1.000000E-06
   Maximum coordinate     =  4.846410E+00

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status: Visible                    333
               Blanked                     14

 Independence: Independent                 18
               Physically Subordinate     304
               Logically Subordinate       25
               Totally Subordinate          0

 Entity use:   Geometry                   225
               Annotation                  88
               Definition                   9
               Other                        0
               Logical/Positional           0
               2D parametric               25
               Construction geometry        0
               Not Specified                0

 Hierarchy:    Structure DE applies       309
               Subordinate DE applies      38
               Hierarchy property applies   0
               Not Specified                0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
102	0	0	26	Composite curve
108	0	0	54	Plane, Unbounded
110	0	30	1	Line
120	0	30	1	Surface of Revolution
122	0	30	7	Tabulated cylinder
124	0	0	8	Transformation matrix
126	0	0	172	Rational B-spline curve
128	0	30	14	Rational B-spline surface
142	0	0	25	Curve on a parametric surface
144	0	30	17	Trimmed surface
402	7	30	4	Group without back-pointers instance
406	15	0	9	Property - Name
410	0	0	9	View - Orthographic parallel

*** Entity Count by Level ***

Level	Count
0	303
30	44

*** Labeling Information ***

100% of the entities are labeled.

Unlabeled 0

Label	Count	Label	Count	Label	Count
VIEW	9	MATRIX	8	PLANE	54
PROPERTY	9	BS CURVE	148	TABSURF	7
MODEL CV	25	PARAM CV	25	CV_ON_SF	25
BOUND SF	17	BS SURF	14	ASC INST	4
LINE	1	SURFREV	1		

*** Line Fonts Used in Data ***

100	102	104	106	108	110	112	114	
-	26	-	-	54	-	-	-	Undefined
-	-	-	-	-	1	-	-	Solid

<<<< *PART OF FILE REMOVED HERE* >>>>>

-	-	-	-	8	-	172	-	Undefined
-	-	1	7	-	-	-	14	Solid

<<<< *PART OF FILE REMOVED HERE* >>>>>

-	-	-	-	-	-	25	-	Undefined
-	-	-	-	-	-	-	17	Solid

<<<< *PART OF FILE REMOVED HERE* >>>>>

```
 *** Line Widths Used in Data ***

     Weight       Count      Width

  Defaulted       303       (1.0000)
       3           44       (3.0000)

 *** Colors Used in Data ***

  Defaulted       303
    Magenta        44

 ************************************
 *****      ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 102

 *** Entity type: 108

 *** Entity type: 110

  --      1 lines averaging 1.000000E+00 units --

 *** Entity type: 120

 *** Entity type: 122

 *** Entity type: 124

8 transformation matrices, 6 non-zero translations.
NOTE    2341: 6 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

 *** Entity type: 142

 *** Entity type: 144

 *** Entity type: 402

 *** Entity type: 406

 *** Entity type: 410

WARNING 2389: Blank status of view at D      1 is set. This flag should be
              ignored.
CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
```

```
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -2.148     XMAX =     2.066
   YMIN =    -1.324     YMAX =     1.885
   ZMIN =    -2.013     ZMAX =     1.453

WARNING 2389: Blank status of view at D     19 is set. This flag should be
              ignored.
CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     19.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =    -4.464     XMAX =     3.672
   YMIN =    -3.365     YMAX =     2.822
   ZMIN =    -3.271     ZMAX =     3.457

WARNING 2389: Blank status of view at D     37 is set. This flag should be
              ignored.
CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =    -2.032     XMAX =     2.510
   YMIN =    -1.733     YMAX =     1.733
   ZMIN =    -0.494     ZMAX =     1.999

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =    -0.970     XMAX =     0.329
   YMIN =    -0.528     YMAX =     0.461
   ZMIN =    -4.874     ZMAX =    -1.758

CAUTION 2397: View at D     71 is not referenced by a drawing, orphan view.
              Scale of view at D     71 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     71.
Orthographic View entity at D     71 has  6 clipping planes specified.
   XMIN =    -2.316     XMAX =     2.180
   YMIN =    -4.533     YMAX =    -1.114
   ZMIN =    -3.515     ZMAX =    -0.527

CAUTION 2397: View at D     89 is not referenced by a drawing, orphan view.
              Scale of view at D     89 is 1.000000E+00.
Orthographic View entity at D     89 has  6 clipping planes specified.
   XMIN =    -2.446     XMAX =     1.805
   YMIN =    -4.938     YMAX =    -1.695
   ZMIN =    -0.525     ZMAX =     0.592

CAUTION 2397: View at D    107 is not referenced by a drawing, orphan view.
              Scale of view at D    107 is 1.000000E+00.
```

```
Orthographic View entity at D    107 has  6 clipping planes specified.
   XMIN =     -2.162      XMAX =      2.095
   YMIN =     -4.938      YMAX =     -1.695
   ZMIN =     -0.836      ZMAX =      0.195

WARNING 2389: Blank status of view at D    125 is set. This flag should be
              ignored.
CAUTION 2397: View at D    125 is not referenced by a drawing, orphan view.
              Scale of view at D    125 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     125.
Orthographic View entity at D    125 has  6 clipping planes specified.
   XMIN =     -1.499      XMAX =      3.035
   YMIN =     -1.503      YMAX =      1.952
   ZMIN =     -3.607      ZMAX =      0.595

WARNING 2389: Blank status of view at D    143 is set. This flag should be
              ignored.
CAUTION 2397: View at D    143 is not referenced by a drawing, orphan view.
              Scale of view at D    143 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     143.
Orthographic View entity at D    143 has  6 clipping planes specified.
   XMIN =     -2.276      XMAX =      2.276
   YMIN =     -1.737      YMAX =      1.737
   ZMIN =     -1.226      ZMAX =      1.226

 *** Message Summary ***

 *** Error Summary ***

     0 fatal errors
     0 severe errors
     0 errors
     5 warnings
    15 cautions
  1718 nitpicks
     1 notes

 *** End of Analysis of 7350010.igs ***
```

13.6.2 Parser Log - CALS

```
**********************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
**********************************

Input file is 7350010.igs

Checking conformance to CALS Class IV (MIL-D-28000A 2/10/92)

Today is January 14, 1994  1:52 PM

**********************************
*****    CHECK FILE SYNTAX    *****
**********************************

   Section        Records

   Start              1
   Global             3
   Directory        694  (    347 Entities)
   Parameter       1786
   Terminate          1

NITPICK 2489: Excess precision in real constant (4.846409797668457) for
              MaxValue
              of Global Section.
NITPICK 2489: Excess precision in real constant (-3.464063646197319) for
              Coef.D
              of D      5.
NITPICK 2489: Messages regarding excess precision suppressed.

**********************************
*****  SUMMARY AND STATISTICS  ****
**********************************

*** File and Product Name Information ***

   File name from sender    = '7350010.igs'
   File creation Date.Time  = '931007.103807'
   Model change Date.Time   = ''
   Author                   = 'Unspecified'
   Department               = 'Unspecified'
   Product name from sender = 'EMS'
   Destination product name = 'Unspecified'

*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'
```

```
 *** Originating System Data ***

    System ID             = 'Intergraph Corp. EMS'
    Preprocessor version  = 'I/CIGES   02.02.01.01 24-Jun-93'
    Specification version = 9 (IGES 5.1)

ERROR   4048: Illegal specification version for CALS Class IV specified.

 *** Precision levels ***
    Integer bits =    32
    Floating point  -  Exponent =    38  Mantissa =     7
    Double precision - Exponent =   308  Mantissa =    15

 *** Global Model Data ***

    Model scale            =  1.0000E+00
    Unit flag              =  1
    Units                  =  'INCH'
    Line weights           =  32
    Maximum line thickness =  3.200000E+01
    Minimum line thickness =  1.000000E+00
    Granularity            =  1.000000E-06
    Maximum coordinate     =  4.846410E+00

    Drafting standard applicable to original data is not specified.

 *** Status Flag Summary ***

  Blank status: Visible                    333
                Blanked                     14

  Independence: Independent                 18
                Physically Subordinate     304
                Logically Subordinate       25
                Totally Subordinate          0

  Entity use:   Geometry                   225
                Annotation                  88
                Definition                   9
                Other                        0
                Logical/Positional           0
                2D parametric               25
                Construction geometry        0
                Not Specified                0

  Hierarchy:    Structure DE applies       309
                Subordinate DE applies      38
                Hierarchy property applies   0
                Not Specified                0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
102	0	0	26	Composite curve
108	0	0	54	Plane, Unbounded
110	0	30	1	Line
120	0	30	1	Surface of Revolution
122	0	30	7	Tabulated cylinder
124	0	0	8	Transformation matrix
126	0	0	172	Rational B-spline curve
128	0	30	14	Rational B-spline surface
142	0	0	25	Curve on a parametric surface
144	0	30	17	Trimmed surface
402	7	30	4	Group without back-pointers instance
406	15	0	9	Property - Name
410	0	0	9	View - Orthographic parallel

ERROR 4030: CALS Class IV requires that at least one drawing be defined.

*** Entity Count by Level ***

Level	Count
0	303
30	44

*** Labeling Information ***

100% of the entities are labeled.

Unlabeled 0

Label	Count	Label	Count	Label	Count
VIEW	9	MATRIX	8	PLANE	54
PROPERTY	9	BS CURVE	148	TABSURF	7
MODEL CV	25	PARAM CV	25	CV_ON_SF	25
BOUND SF	17	BS SURF	14	ASC INST	4
LINE	1	SURFREV	1		

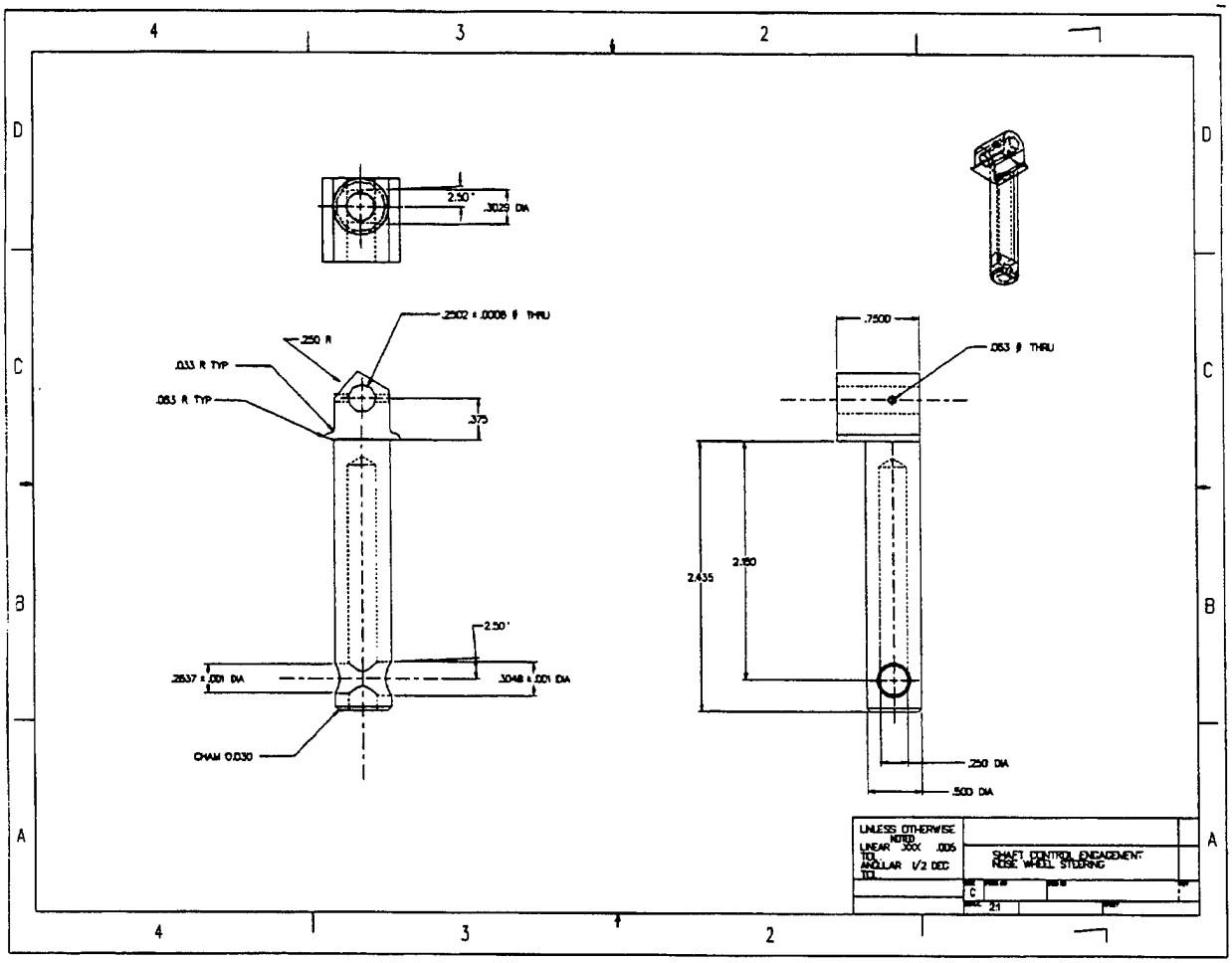
```
*** Line Fonts Used in Data ***

100   102   104   106   108   110   112   114

 -     26    -     -     54    -     -     -    Undefined
 -     -     -     -     -      1    -     -    Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

116   118   120   122   124   125   126   128

 -     -     -     -      8    -    172    -    Undefined
 -     -      1     7    -     -     -     14   Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

130   132   134   136   138   140   142   144

 -     -     -     -     -     -     25    -    Undefined
 -     -     -     -     -     -     -     17   Solid
 -     -     -     -     -     -     -     -    Dashed
 -     -     -     -     -     -     -     -    Phantom
 -     -     -     -     -     -     -     -    Center-line
 -     -     -     -     -     -     -     -    Dotted
 -     -     -     -     -     -     -     -    User defined

*** Line Widths Used in Data ***

    Weight       Count      Width

 Defaulted       303       (1.0000)
      3           44       (3.0000)

*** Colors Used in Data ***

 Defaulted       303
   Magenta        44

**********************************
*****     ENTITY ANALYSIS     *****
**********************************

*** Entity type: 102

ERROR   4046: Illegal line font for CALS Class IV specified in D    173.
ERROR   4046: Illegal line font for CALS Class IV specified in D    183.
ERROR   4046: Illegal line font for CALS Class IV specified in D    211.
ERROR   4046: Messages regarding illegal line fonts suppressed.
```

```
 *** Entity type: 108

ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D      5.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D      7.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D      9.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D     11.
ERROR   4044: Messages regarding hierarchy flags suppressed.

 *** Entity type: 110

  --     1 lines averaging 1.000000E+00 units --

 *** Entity type: 120

 *** Entity type: 122

 *** Entity type: 124

8 transformation matrices, 6 non-zero translations.
NOTE    2341: 6 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

 *** Entity type: 142

 *** Entity type: 144

 *** Entity type: 402

 *** Entity type: 406

 *** Entity type: 410

WARNING 2389: Blank status of view at D      1 is set. This flag should be
              ignored.
CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -2.148     XMAX =     2.066
   YMIN =    -1.324     YMAX =     1.885
   ZMIN =    -2.013     ZMAX =     1.453

WARNING 2389: Blank status of view at D     19 is set. This flag should be
              ignored.
CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     19.
```

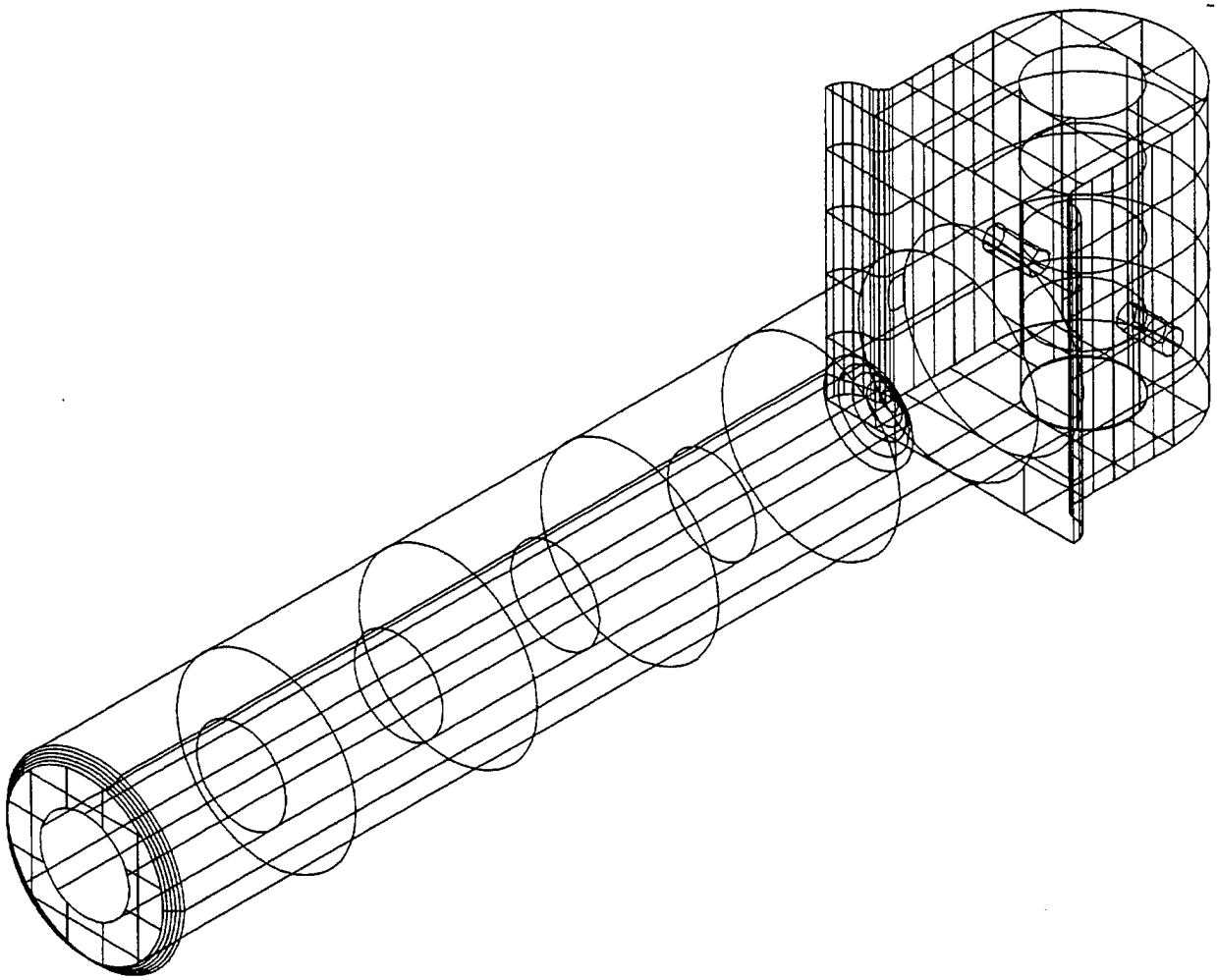
```
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =     -4.464      XMAX =      3.672
   YMIN =     -3.365      YMAX =      2.822
   ZMIN =     -3.271      ZMAX =      3.457

WARNING 2389: Blank status of view at D     37 is set. This flag should be
              ignored.
CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =     -2.032      XMAX =      2.510
   YMIN =     -1.733      YMAX =      1.733
   ZMIN =     -0.494      ZMAX =      1.999

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =     -0.970      XMAX =      0.329
   YMIN =     -0.528      YMAX =      0.461
   ZMIN =     -4.874      ZMAX =     -1.758

CAUTION 2397: View at D     71 is not referenced by a drawing, orphan view.
              Scale of view at D     71 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     71.
Orthographic View entity at D     71 has  6 clipping planes specified.
   XMIN =     -2.316      XMAX =      2.180
   YMIN =     -4.533      YMAX =     -1.114
   ZMIN =     -3.515      ZMAX =     -0.527

CAUTION 2397: View at D     89 is not referenced by a drawing, orphan view.
              Scale of view at D     89 is 1.000000E+00.
Orthographic View entity at D     89 has  6 clipping planes specified.
   XMIN =     -2.446      XMAX =      1.805
   YMIN =     -4.938      YMAX =     -1.695
   ZMIN =     -0.525      ZMAX =      0.592

CAUTION 2397: View at D    107 is not referenced by a drawing, orphan view.
              Scale of view at D    107 is 1.000000E+00.
Orthographic View entity at D    107 has  6 clipping planes specified.
   XMIN =     -2.162      XMAX =      2.095
   YMIN =     -4.938      YMAX =     -1.695
   ZMIN =     -0.836      ZMAX =      0.195

WARNING 2389: Blank status of view at D    125 is set. This flag should be
              ignored.
CAUTION 2397: View at D    125 is not referenced by a drawing, orphan view.
              Scale of view at D    125 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at  D     125.
```

```
Orthographic View entity at D    125 has  6 clipping planes specified.
   XMIN =     -1.499      XMAX =      3.035
   YMIN =     -1.503      YMAX =      1.952
   ZMIN =     -3.607      ZMAX =      0.595

WARNING 2389: Blank status of view at D    143 is set. This flag should be
              ignored.
CAUTION 2397: View at D    143 is not referenced by a drawing, orphan view.
              Scale of view at D    143 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     143.
Orthographic View entity at D    143 has  6 clipping planes specified.
   XMIN =     -2.276      XMAX =      2.276
   YMIN =     -1.737      YMAX =      1.737
   ZMIN =     -1.226      ZMAX =      1.226

 *** Message Summary ***

4000: 1 Miscellaneous CALS messages
4011: 1 Problems in the Global section
4016: 277 Illegal line fonts
4021: 292 Illegal hierarchy flags

 *** Error Summary ***

     0 fatal errors
     0 severe errors
   571 errors
     5 warnings
    15 cautions
  1718 nitpicks
     1 notes

 *** End of Analysis of 7350010.igs ***
```

13.6.3 Output Drawing File



13.6.4 Output Model File



13.7 Part 22 - Intergraph

13.7.1 Parser Log - Basic IGES

```
************************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
************************************

Input file is 735003.igs

Checking conformance to Standard IGES

Today is January 18, 1994  11:38 AM

************************************
*****    CHECK FILE SYNTAX    *****
************************************

   Section        Records

   Start              1
   Global             3
   Directory        298  (    149 Entities)
   Parameter        361
   Terminate          1

NITPICK 2489: Excess precision in real constant (22.615537643432617) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (8.533258317800668) for Coef.D
              of D      5.
NITPICK 2489: Excess precision in real constant (7.153507690429688) for Coef.D
              of D      7.
NITPICK 2489: Messages regarding excess precision suppressed.

************************************
*****  SUMMARY AND STATISTICS  ****
************************************

*** File and Product Name Information ***

   File name from sender    = '735003.igs'
   File creation Date.Time  = '931003.155037'
   Model change Date.Time   = ''
   Author                   = 'Unspecified'
   Department               = 'Unspecified'
   Product name from sender = 'EMS'
   Destination product name = 'Unspecified'
```

```
*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'Intergraph Corp. EMS'
   Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
   Specification version = 9 (IGES 5.1)

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     7
   Double precision - Exponent =   308  Mantissa =    15

*** Global Model Data ***

   Model scale            =  1.0000E+00
   Unit flag              =  1
   Units                  =  'INCH'
   Line weights           =  32
   Maximum line thickness =  3.200000E+01
   Minimum line thickness =  1.000000E+00
   Granularity            =  1.000000E-06
   Maximum coordinate     =  2.261554E+01

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status: Visible                    120
               Blanked                     29

 Independence: Independent                 13
               Physically Subordinate     122
               Logically Subordinate       14
               Totally Subordinate          0

 Entity use:   Geometry                    85
               Annotation                  35
               Definition                  17
               Other                        0
               Logical/Positional           0
               2D parametric               12
               Construction geometry        0
               Not Specified                0

 Hierarchy:    Structure DE applies       133
               Subordinate DE applies      16
               Hierarchy property applies   0
               Not Specified                0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
102	0	0	4	Composite curve
102	0	3	1	
108	0	0	30	Plane, Unbounded
110	0	2	6	Line
110	0	3	12	
120	0	2	6	Surface of Revolution
122	0	2	5	Tabulated cylinder
124	0	0	5	Transformation matrix
126	0	0	47	Rational B-spline curve
128	0	2	3	Rational B-spline surface
142	0	0	12	Curve on a parametric surface
144	0	2	7	Trimmed surface
402	7	2	1	Group without back-pointers instance
406	15	0	5	Property - Name
410	0	0	5	View - Orthographic parallel

*** Entity Count by Level ***

Level	Count
0	108
2	28
3	13

*** Labeling Information ***

99% of the entities are labeled.

Unlabeled 1

Label	Count	Label	Count	Label	Count
VIEW	5	MATRIX	5	PLANE	30
PROPERTY	5	LINE	18	COMP CRV	1
BS CURVE	27	TABSURF	5	MODEL CV	12
PARAM CV	12	CV_ON_SF	12	BOUND SF	7
SURFREV	6	BS SURF	3		

```
*** Line Fonts Used in Data ***

100   102   104   106   108   110   112   114

 -     4    -     -     30    -     -     -    Undefined
 -     1    -     -     -     17    -     -    Solid
 -     -    -     -     -     -     -     -    Dashed
 -     -    -     -     -     -     -     -    Phantom
 -     -    -     -     -      1    -     -    Center-line
 -     -    -     -     -     -     -     -    Dotted
 -     -    -     -     -     -     -     -    User defined

116   118   120   122   124   125   126   128

 -     -     -     -      5    -     47    -    Undefined
 -     -      6     5    -     -     -     3    Solid

                        <<<<< PART OF FILE REMOVED HERE >>>>>

 -     -     -     -     -     -     12    -    Undefined
 -     -     -     -     -     -     -     7    Solid

                        <<<<< PART OF FILE REMOVED HERE >>>>>

*** Line Widths Used in Data ***

    Weight       Count      Width

 Defaulted       108       (1.0000)
      3           41       (3.0000)

*** Colors Used in Data ***

 Defaulted       108
    Yellow        28
   Magenta        11
      Cyan         2

************************************
*****     ENTITY ANALYSIS      *****
************************************

*** Entity type: 102

*** Entity type: 108

*** Entity type: 110

 --    18 lines averaging 4.177022E-01 units --

*** Entity type: 120

*** Entity type: 122

*** Entity type: 124
```

```
5 transformation matrices, 5 non-zero translations.
NOTE    2341: 5 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

 *** Entity type: 142

 *** Entity type: 144

 *** Entity type: 402

 *** Entity type: 406

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -0.864     XMAX =     0.887
   YMIN =    -0.750     YMAX =     0.607
   ZMIN =    -0.623     ZMAX =     0.623

CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     19.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =    -1.468     XMAX =     1.238
   YMIN =    -1.121     YMAX =     0.972
   ZMIN =    -1.012     ZMAX =     1.222

CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =    -0.790     XMAX =     0.806
   YMIN =    -0.619     YMAX =     0.619
   ZMIN =    -0.556     ZMAX =     0.608

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     55.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =    -0.754     XMAX =     0.844
   YMIN =    -0.690     YMAX =     0.548
   ZMIN =    -0.341     ZMAX =     0.204
```

```
CAUTION 2397: View at D      73 is not referenced by a drawing, orphan view.
              Scale of view at D      73 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D      73.
Orthographic View entity at D      73 has  6 clipping planes specified.
   XMIN =     -0.516      XMAX =      0.700
   YMIN =     -0.434      YMAX =      0.508
   ZMIN =     -0.380      ZMAX =      0.380

 *** Message Summary ***

 *** Error Summary ***

     0 fatal errors
     0 severe errors
     0 errors
     0 warnings
    10 cautions
   300 nitpicks
     1 notes

 *** End of Analysis of 735003.igs ***
```

13.7.2 Parser Log - CALS

```
 ************************************
 *****  IGES PARSER/VERIFIER   *****
 *****       MARCH 1993        *****
 *****   IGES Data Analysis    *****
 *****     (708) 344-1815      *****
 ************************************

 Input file is 735003.igs

 Checking conformance to CALS Class IV (MIL-D-28000A 2/10/92)

 Today is December 2, 1993  2:23 PM

 ************************************
 *****    CHECK FILE SYNTAX    *****
 ************************************

    Section        Records

    Start              1
    Global             3
    Directory        298  (    149 Entities)
    Parameter        361
    Terminate          1

NITPICK 2489: Excess precision in real constant (22.615537643432617) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (8.533258317800668) for Coef.D
              of D      5.
```

```
NITPICK 2489: Excess precision in real constant (7.153507690429688) for Coef.D
              of D      7.
NITPICK 2489: Excess precision in real constant (10.284088255075308) for
              Coef.D     of D     9.
NITPICK 2489: Messages regarding excess precision suppressed.

 ***********************************
 *****  SUMMARY AND STATISTICS  ****
 ***********************************

 *** File and Product Name Information ***

    File name from sender     = '735003.igs'
    File creation Date.Time   = '930910.102457'
    Model change Date.Time    = ''
    Author                    = 'Unspecified'
    Department                = 'Unspecified'
    Product name from sender  = 'EMS'
    Destination product name  = 'Unspecified'

 *** Parameter Delimiters ***

    Delimiter  = ','
    Terminator = ';'

 *** Originating System Data ***

    System ID              = 'Intergraph Corp. EMS'
    Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
    Specification version = 9 (IGES 5.1)

ERROR   4048: Illegal specification version for CALS Class IV specified.

 *** Precision levels ***
    Integer bits =    32
    Floating point  -  Exponent =    38  Mantissa =     7
    Double precision - Exponent =   308  Mantissa =    15

 *** Global Model Data ***

    Model scale             =  1.0000E+00
    Unit flag               =  1
    Units                   =  'INCH'
    Line weights            =  32
    Maximum line thickness  =  3.200000E+01
    Minimum line thickness  =  1.000000E+00
    Granularity             =  1.000000E-06
    Maximum coordinate      =  2.261554E+01

    Drafting standard applicable to original data is not specified.
```

*** Status Flag Summary ***

Blank status:	Visible	120
	Blanked	29
Independence:	Independent	13
	Physically Subordinate	122
	Logically Subordinate	14
	Totally Subordinate	0
Entity use:	Geometry	85
	Annotation	35
	Definition	17
	Other	0
	Logical/Positional	0
	2D parametric	12
	Construction geometry	0
	Not Specified	0
Hierarchy:	Structure DE applies	133
	Subordinate DE applies	16
	Hierarchy property applies	0
	Not Specified	0

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
102	0	0	4	Composite curve
102	0	3	1	
108	0	0	30	Plane, Unbounded
110	0	2	6	Line
110	0	3	12	
120	0	2	6	Surface of Revolution
122	0	2	5	Tabulated cylinder
124	0	0	5	Transformation matrix
126	0	0	47	Rational B-spline curve
128	0	2	3	Rational B-spline surface
142	0	0	12	Curve on a parametric surface
144	0	2	7	Trimmed surface
402	7	2	1	Group without back-pointers instance
406	15	0	5	Property - Name
410	0	0	5	View - Orthographic parallel

ERROR 4030: CALS Class IV requires that at least one drawing be defined.

*** Entity Count by Level ***

Level	Count
0	108
2	28
3	13

*** Labeling Information ***

99% of the entities are labeled.

Unlabeled 1

Label	Count	Label	Count	Label	Count
VIEW	5	MATRIX	5	PLANE	30
PROPERTY	5	LINE	18	COMP CRV	1
BS CURVE	27	TABSURF	5	MODEL CV	12
PARAM CV	12	CV_ON_SF	12	BOUND SF	7
SURFREV	6	BS SURF	3		

*** Line Fonts Used in Data ***

100	102	104	106	108	110	112	114	
-	4	-	-	30	-	-	-	Undefined
-	1	-	-	-	17	-	-	Solid
-	-	-	-	-	-	-	-	Dashed
-	-	-	-	-	-	-	-	Phantom
-	-	-	-	-	1	-	-	Center-line
-	-	-	-	-	-	-	-	Dotted
-	-	-	-	-	-	-	-	User defined

116	118	120	122	124	125	126	128	
-	-	-	-	5	-	47	-	Undefined
-	-	6	5	-	-	-	3	Solid

<<<<< *PART OF LOG REMOVED HERE* >>>>>

-	-	-	-	-	-	12	-	Undefined
-	-	-	-	-	-	-	7	Solid

<<<<< *PART OF LOG REMOVED HERE* >>>>>

*** Line Widths Used in Data ***

Weight	Count	Width
Defaulted	108	(1.0000)
3	41	(3.0000)

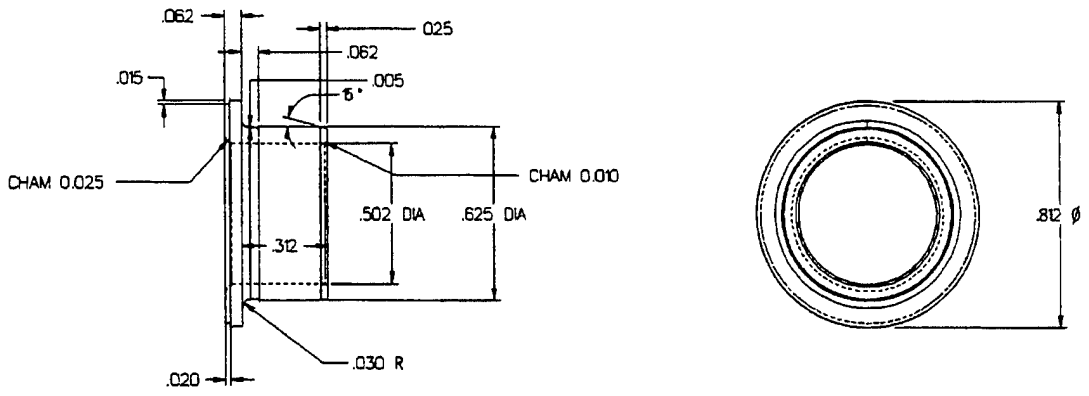
*** Colors Used in Data ***

Defaulted	108
Yellow	28
Magenta	11
Cyan	2

```
 ************************************
 *****     ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 102

ERROR   4046: Illegal line font for CALS Class IV specified in D    147.
ERROR   4046: Illegal line font for CALS Class IV specified in D    157.
ERROR   4046: Illegal line font for CALS Class IV specified in D    225.
ERROR   4046: Illegal line font for CALS Class IV specified in D    235.

 *** Entity type: 108

ERROR   4046: Illegal line font for CALS Class IV specified in D      5.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D      5.
ERROR   4046: Illegal line font for CALS Class IV specified in D      7.
ERROR   4046: Messages regarding illegal line fonts suppressed.
ERROR   4044: Illegal hierarchy flag for CALS Class IV specified at D     23.
ERROR   4044: Messages regarding hierarchy flags suppressed.

 *** Entity type: 110

  --    18 lines averaging 4.177022E-01 units --

 *** Entity type: 120

 *** Entity type: 122

 *** Entity type: 124

5 transformation matrices, 5 non-zero translations.
NOTE    2341: 5 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

 *** Entity type: 142

 *** Entity type: 144

 *** Entity type: 402

 *** Entity type: 406

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -0.864     XMAX =     0.887
   YMIN =    -0.750     YMAX =     0.607
   ZMIN =    -0.623     ZMAX =     0.623
```

```
CAUTION 2397: View at D      19 is not referenced by a drawing, orphan view.
              Scale of view at D      19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D      19.
Orthographic View entity at D      19 has  6 clipping planes specified.
   XMIN =     -1.468      XMAX =      1.238
   YMIN =     -1.121      YMAX =      0.972
   ZMIN =     -1.012      ZMAX =      1.222

CAUTION 2397: View at D      37 is not referenced by a drawing, orphan view.
              Scale of view at D      37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D      37.
Orthographic View entity at D      37 has  6 clipping planes specified.
   XMIN =     -0.790      XMAX =      0.806
   YMIN =     -0.619      YMAX =      0.619
   ZMIN =     -0.556      ZMAX =      0.608

CAUTION 2397: View at D      55 is not referenced by a drawing, orphan view.
              Scale of view at D      55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D      55.
Orthographic View entity at D      55 has  6 clipping planes specified.
   XMIN =     -0.754      XMAX =      0.844
   YMIN =     -0.690      YMAX =      0.548
   ZMIN =     -0.341      ZMAX =      0.204

CAUTION 2397: View at D      73 is not referenced by a drawing, orphan view.
              Scale of view at D      73 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D      73.
Orthographic View entity at D      73 has  6 clipping planes specified.
   XMIN =     -0.516      XMAX =      0.700
   YMIN =     -0.434      YMAX =      0.508
   ZMIN =     -0.380      ZMAX =      0.380

 *** Message Summary ***

4000: 1 Miscellaneous CALS messages
4011: 1 Problems in the Global section
4016: 93 Illegal line fonts
4021: 123 Illegal hierarchy flags

 *** Error Summary ***

     0 fatal errors
     0 severe errors
   218 errors
     0 warnings
    10 cautions
   300 nitpicks
     1 notes

 *** End of Analysis of 735003.igs ***
```

13.7.3 Output Drawing File



13.8. Part 23 - Intergraph

13.8.1 Parser Log - Basic IGES

```
 ***********************************
 *****  IGES PARSER/VERIFIER   *****
 *****       MARCH 1993        *****
 *****   IGES Data Analysis    *****
 *****     (708) 344-1815      *****
 ***********************************

 Input file is 7350008.igs

 Checking conformance to Standard IGES

 Today is January 18, 1994  11:42 AM

 ***********************************
 *****    CHECK FILE SYNTAX    *****
 ***********************************

    Section        Records

    Start              1
    Global             4
    Directory        634  (    317 Entities)
    Parameter       1494
    Terminate          1

NITPICK 2489: Excess precision in real constant (21.370073318481445) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-13.172136) for Mat[0][3]
              of D     3.
NITPICK 2489: Excess precision in real constant (-100.968204) for Mat[2][3]
              of D     3.
NITPICK 2489: Messages regarding excess precision suppressed.

 ***********************************
 *****  SUMMARY AND STATISTICS  ****
 ***********************************

 *** File and Product Name Information ***

    File name from sender     = '7350008.igs'
    File creation Date.Time   = '931003.154957'
    Model change Date.Time    = ''
    Author                    = 'Unspecified'
    Department                = 'Unspecified'
    Product name from sender  = 'EMS'
    Destination product name  = 'Unspecified'
```

```
*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'Intergraph Corp. EMS'
   Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
   Specification version = 9 (IGES 5.1)

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     7
   Double precision - Exponent =   308  Mantissa =    15

*** Global Model Data ***

   Model scale             =  1.0000E+00
   Unit flag               =  1
   Units                   =  'INCH'
   Line weights            =  32
   Maximum line thickness =  3.200000E+01
   Minimum line thickness =  1.000000E+00
   Granularity             =  1.000000E-06
   Maximum coordinate      =  2.137007E+01

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status: Visible                    287
               Blanked                     30

 Independence: Independent                 37
               Physically Subordinate     265
               Logically Subordinate       15
               Totally Subordinate          0

 Entity use:   Geometry                   253
               Annotation                  35
               Definition                   4
               Other                        0
               Logical/Positional           0
               2D parametric               25
               Construction geometry        0
               Not Specified                0

 Hierarchy:    Structure DE applies       282
               Subordinate DE applies      35
               Hierarchy property applies   0
               Not Specified                0
```

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	100	8	Circular arc
102	0	0	26	Composite curve
102	0	100	4	
108	0	0	30	Plane, Unbounded
110	0	2	5	Line
110	0	100	27	
116	0	2	4	Point
116	0	100	4	
122	0	3	4	Tabulated cylinder
124	0	0	13	Transformation matrix
126	0	0	132	Rational B-spline curve
128	0	3	2	Rational B-spline surface
128	2	3	5	Rational B-spline surface - Right circular cylinder
128	3	3	2	Rational B-spline surface - Cone
142	0	0	25	Curve on a parametric surface
144	0	3	14	Trimmed surface
402	7	0	1	Group without back-pointers instance
402	7	3	1	
406	15	0	5	Property - Name
410	0	0	5	View - Orthographic parallel

*** Entity Count by Level ***

Level	Count
0	237
2	9
3	28
100	43

*** Labeling Information ***

99% of the entities are labeled.

Unlabeled 2

Label	Count	Label	Count	Label	Count
VIEW	5	MATRIX	13	PLANE	30
PROPERTY	5	POINT	8	LINE	32
CIRARC	8	COMP CRV	4	BS SURF	9
BS CURVE	108	MODEL CV	25	PARAM CV	25
CV_ON_SF	25	BOUND SF	14	TABSURF	4

*** Line Fonts Used in Data ***

100	102	104	106	108	110	112	114	
-	26	-	-	30	-	-	-	Undefined
8	4	-	-	-	32	-	-	Solid

```
                        <<<<< PART OF LOG REMOVED HERE >>>>>

  -    -    -    -    13    -   132    -   Undefined
  8    -    -    4    -     -    -     9   Solid

                        <<<<< PART OF LOG REMOVED HERE >>>>>

  -    -    -    -    -     -    25    -   Undefined
  -    -    -    -    -     -    -    14   Solid

                        <<<<< PART OF LOG REMOVED HERE >>>>>

 *** Line Widths Used in Data ***

     Weight       Count      Width

  Defaulted       237       (1.0000)
       6            8       (6.0000)
       3           72       (3.0000)

 *** Colors Used in Data ***

  Defaulted       237
     Yellow        15
    Magenta         5
       Cyan        60

 ************************************
 *****     ENTITY ANALYSIS      *****
 ************************************

 *** Entity type: 100

 *** Entity type: 102

 *** Entity type: 108

 *** Entity type: 110

  --    32 lines averaging 1.022777E+00 units --

 *** Entity type: 116

 *** Entity type: 122

 *** Entity type: 124

13 transformation matrices, 13 non-zero translations.
NOTE    2341: 13 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

 *** Entity type: 142
```

```
 *** Entity type: 144

 *** Entity type: 402

 *** Entity type: 406

 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -6.876     XMAX =     0.041
   YMIN =    -0.998     YMAX =     4.270
   ZMIN =  -102.625     ZMAX =  -100.553

CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     19.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =    -1.982     XMAX =     3.580
   YMIN =    -2.029     YMAX =     2.201
   ZMIN =  -106.926     ZMAX =  -102.027

CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =    -0.863     XMAX =     3.250
   YMIN =    -0.980     YMAX =     2.158
   ZMIN =  -103.971     ZMAX =  -100.178

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     55.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =    -0.743     XMAX =     3.369
   YMIN =    -2.356     YMAX =     0.782
   ZMIN =    -2.051     ZMAX =     1.743

CAUTION 2397: View at D     73 is not referenced by a drawing, orphan view.
              Scale of view at D     73 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     73.
Orthographic View entity at D     73 has  6 clipping planes specified.
   XMIN =    -1.318     XMAX =     2.456
   YMIN =    -0.685     YMAX =     2.191
   ZMIN =  -103.274     ZMAX =  -100.292
```

```
*** Message Summary ***

*** Error Summary ***

    0 fatal errors
    0 severe errors
    0 errors
    0 warnings
   10 cautions
 1753 nitpicks
    1 notes

*** End of Analysis of 7350008.igs ***
```

13.8.2 Parser Log - CALS

```
************************************
*****  IGES PARSER/VERIFIER   *****
*****       MARCH 1993        *****
*****   IGES Data Analysis    *****
*****     (708) 344-1815      *****
************************************

Input file is 7350008.igs

Checking conformance to CALS Class IV (MIL-D-28000A 2/10/92)

Today is December 2, 1993  2:21 PM

************************************
*****    CHECK FILE SYNTAX    *****
************************************

   Section        Records

   Start              1
   Global             4
   Directory        634   (    317 Entities)
   Parameter       1494
   Terminate          1

NITPICK 2489: Excess precision in real constant (21.370073318481445) for
              MaxValue of Global Section.
NITPICK 2489: Excess precision in real constant (-13.172136) for Mat[0][3]
              of D     3.
NITPICK 2489: Excess precision in real constant (-100.968204) for Mat[2][3]
              of D     3.
NITPICK 2489: Excess precision in real constant (6.296345157623291) for Coef.D
              of D     5.
NITPICK 2489: Messages regarding excess precision suppressed.
```

```
**********************************
*****  SUMMARY AND STATISTICS  ****
**********************************

*** File and Product Name Information ***

   File name from sender     = '7350008.igs'
   File creation Date.Time   = '930910.102238'
   Model change Date.Time    = ''
   Author                    = 'Unspecified'
   Department                = 'Unspecified'
   Product name from sender  = 'EMS'
   Destination product name  = 'Unspecified'

*** Parameter Delimiters ***

   Delimiter  = ','
   Terminator = ';'

*** Originating System Data ***

   System ID              = 'Intergraph Corp. EMS'
   Preprocessor version   = 'I/CIGES   02.02.01.01 24-Jun-93'
   Specification version = 9 (IGES 5.1)

ERROR   4048: Illegal specification version for CALS Class IV specified.

*** Precision levels ***
   Integer bits =    32
   Floating point  -  Exponent =    38  Mantissa =     7
   Double precision - Exponent =   308  Mantissa =    15

*** Global Model Data ***

   Model scale             =  1.0000E+00
   Unit flag               =  1
   Units                   =  'INCH'
   Line weights            =  32
   Maximum line thickness  =  3.200000E+01
   Minimum line thickness  =  1.000000E+00
   Granularity             =  1.000000E-06
   Maximum coordinate      =  2.137007E+01

   Drafting standard applicable to original data is not specified.

*** Status Flag Summary ***

 Blank status: Visible                    287
               Blanked                     30

 Independence: Independent                 37
               Physically Subordinate     265
               Logically Subordinate       15
               Totally Subordinate          0
```

Entity use:	Geometry	253
	Annotation	35
	Definition	4
	Other	0
	Logical/Positional	0
	2D parametric	25
	Construction geometry	0
	Not Specified	0
Hierarchy:	Structure DE applies	282
	Subordinate DE applies	35
	Hierarchy property applies	0
	Not Specified	0

*** Entity Occurrence Counts ***

Entity	Form	Level	Count	Type
100	0	100	8	Circular arc
102	0	0	26	Composite curve
102	0	100	4	
108	0	0	30	Plane, Unbounded
110	0	2	5	Line
110	0	100	27	
116	0	2	4	Point
116	0	100	4	
122	0	3	4	Tabulated cylinder
124	0	0	13	Transformation matrix
126	0	0	132	Rational B-spline curve
128	0	3	2	Rational B-spline surface
128	2	3	5	Rational B-spline surface - Right circular cylinder
128	3	3	2	Rational B-spline surface - Cone
142	0	0	25	Curve on a parametric surface
144	0	3	14	Trimmed surface
402	7	0	1	Group without back-pointers instance
402	7	3	1	
406	15	0	5	Property - Name
410	0	0	5	View - Orthographic parallel

ERROR 4030: CALS Class IV requires that at least one drawing be defined.

*** Entity Count by Level ***

Level	Count
0	237
2	9
3	28
100	43

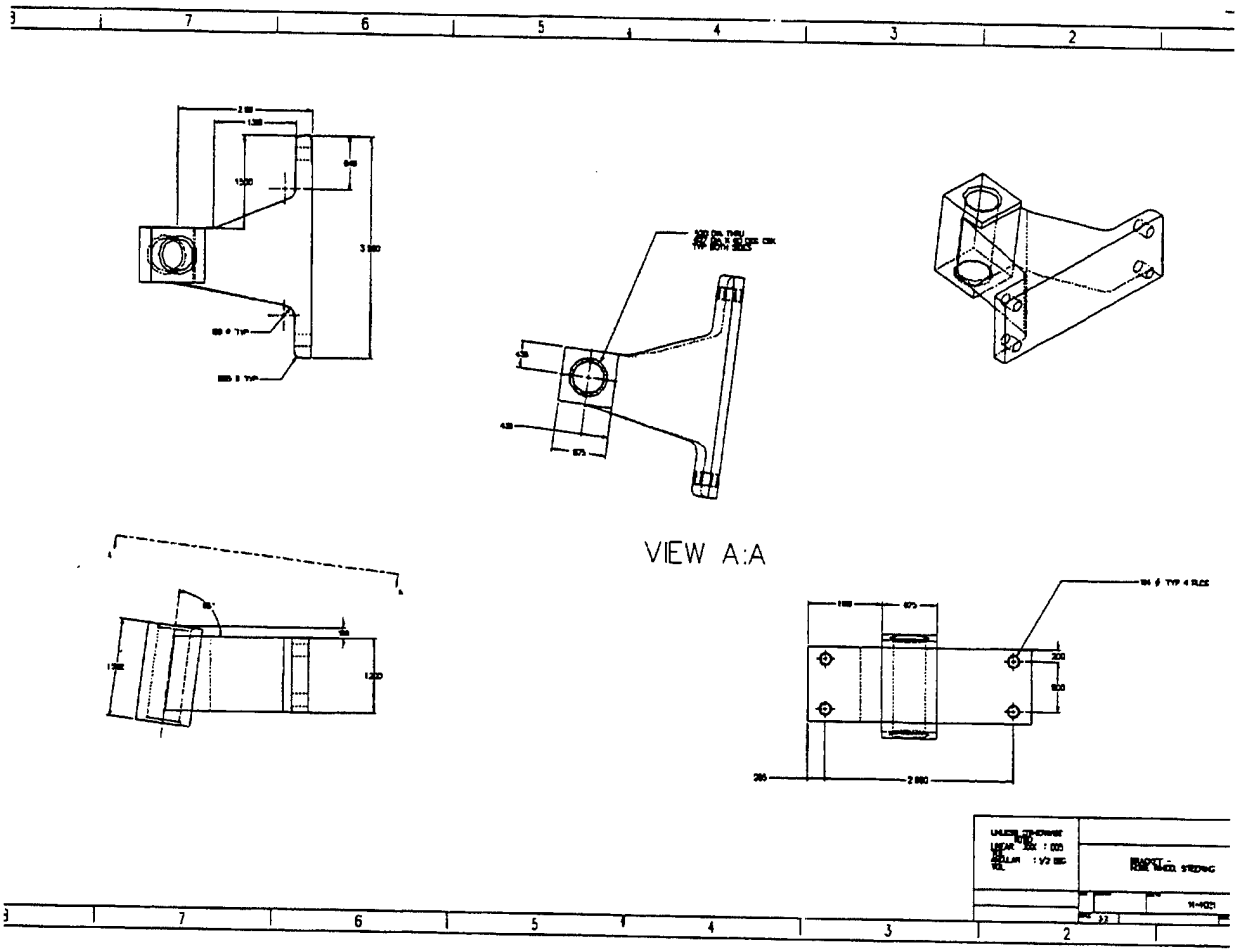
```
*** Labeling Information ***

  99% of the entities are labeled.

   Unlabeled       2

     Label       Count       Label       Count       Label       Count

      VIEW           5      MATRIX          13       PLANE          30
  PROPERTY           5       POINT           8        LINE          32
    CIRARC           8    COMP CRV           4     BS SURF           9
  BS CURVE         108    MODEL CV          25    PARAM CV          25
  CV_ON_SF          25    BOUND SF          14     TABSURF           4

*** Line Fonts Used in Data ***

100   102   104   106   108   110   112   114

 -     26    -     -     30    -     -     -    Undefined
  8     4    -     -     -     32    -     -    Solid

                         <<<<< PART OF LOG REMOVED HERE >>>>>

 -     -     -     -     13    -    132    -    Undefined
  8    -     -      4    -     -     -     9    Solid

                         <<<<< PART OF LOG REMOVED HERE >>>>>

 -     -     -     -     -     -     25    -    Undefined
 -     -     -     -     -     -     -     14   Solid

                         <<<<< PART OF LOG REMOVED HERE >>>>>

*** Line Widths Used in Data ***

    Weight       Count      Width

 Defaulted       237       (1.0000)
      6            8       (6.0000)
      3           72       (3.0000)

*** Colors Used in Data ***

 Defaulted       237
    Yellow        15
   Magenta         5
      Cyan        60

************************************
*****     ENTITY ANALYSIS     *****
************************************
```

```
 *** Entity type: 100

ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D    103.
ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D    109.
ERROR    4044: Messages regarding hierarchy flags suppressed.

 *** Entity type: 102

ERROR    4046: Illegal line font for CALS Class IV specified in D    215.
ERROR    4046: Illegal line font for CALS Class IV specified in D    225.
ERROR    4046: Messages regarding illegal line fonts suppressed.

 *** Entity type: 108

ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D      5.
ERROR    4044: Illegal hierarchy flag for CALS Class IV specified at D      7.
ERROR    4044: Messages regarding hierarchy flags suppressed.

 *** Entity type: 110

  --    32 lines averaging 1.022777E+00 units --

 *** Entity type: 116

 *** Entity type: 122

 *** Entity type: 124

13 transformation matrices, 13 non-zero translations.
NOTE     2341: 13 matrices contain translation information.

 *** Entity type: 126

 *** Entity type: 128

ERROR    4042: Illegal form for CALS Class IV specified at D    437.
ERROR    4042: Illegal form for CALS Class IV specified at D    463.
ERROR    4042: Illegal form for CALS Class IV specified at D    489.
ERROR    4042: Illegal form for CALS Class IV specified at D    515.
ERROR    4042: Illegal form for CALS Class IV specified at D    541.
ERROR    4042: Illegal form for CALS Class IV specified at D    567.
ERROR    4042: Illegal form for CALS Class IV specified at D    597.

 *** Entity type: 142

 *** Entity type: 144

 *** Entity type: 402

 *** Entity type: 406
```

```
 *** Entity type: 410

CAUTION 2397: View at D      1 is not referenced by a drawing, orphan view.
              Scale of view at D      1 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     1.
Orthographic View entity at D      1 has  6 clipping planes specified.
   XMIN =    -6.876     XMAX =     0.041
   YMIN =    -0.998     YMAX =     4.270
   ZMIN =  -102.625     ZMAX =  -100.553

CAUTION 2397: View at D     19 is not referenced by a drawing, orphan view.
              Scale of view at D     19 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     19.
Orthographic View entity at D     19 has  6 clipping planes specified.
   XMIN =    -1.982     XMAX =     3.580
   YMIN =    -2.029     YMAX =     2.201
   ZMIN =  -106.926     ZMAX =  -102.027

CAUTION 2397: View at D     37 is not referenced by a drawing, orphan view.
              Scale of view at D     37 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     37.
Orthographic View entity at D     37 has  6 clipping planes specified.
   XMIN =    -0.863     XMAX =     3.250
   YMIN =    -0.980     YMAX =     2.158
   ZMIN =  -103.971     ZMAX =  -100.178

CAUTION 2397: View at D     55 is not referenced by a drawing, orphan view.
              Scale of view at D     55 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     55.
Orthographic View entity at D     55 has  6 clipping planes specified.
   XMIN =    -0.743     XMAX =     3.369
   YMIN =    -2.356     YMAX =     0.782
   ZMIN =    -2.051     ZMAX =     1.743

CAUTION 2397: View at D     73 is not referenced by a drawing, orphan view.
              Scale of view at D     73 is 1.000000E+00.
CAUTION 2315: Matrix associated with view contains translation information
              at D     73.
Orthographic View entity at D     73 has  6 clipping planes specified.
   XMIN =    -1.318     XMAX =     2.456
   YMIN =    -0.685     YMAX =     2.191
   ZMIN =  -103.274     ZMAX =  -100.292
```

```
 *** Message Summary ***

4000: 1 Miscellaneous CALS messages
4011: 1 Problems in the Global section
4016: 214 Illegal line fonts
4019: 7 Entities with illegal form
4021: 264 Illegal hierarchy flags

 *** Error Summary ***

     0 fatal errors
     0 severe errors
   487 errors
     0 warnings
    10 cautions
  1753 nitpicks
     1 notes

 *** End of Analysis of 7350008.igs ***
```

13.8.3 Output Drawing File



13.9 Complete Assembly

13.9.1 Output Drawing